READERS
IN
ELEMENTARY SCIENCE
AND
GEOGRAPHY

BOOK I

VINCENT T. MURCHÉ

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READERS

IN

ELEMENTARY SCIENCE

AND

GEOGRAPHY

BY

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'THE TEACHERS' MANUALS OF OBJECT LESSONS IN ELEMENTARY SCIENCE,' 'OBJECT LESSONS IN DOMESTIC ECONOMY,' 'OBJECT LESSONS FOR INFANTS,' 'OBJECT LESSONS IN ELEMENTARY SCIENCE AND GEOGRAPHY,' 'OBJECT LESSONS FOR RURAL SCHOOLS,' 'OBJECT LESSONS IN GEOGRAPHY,' 'SCIENCE READERS,' 'DOMESTIC SCIENCE READERS,' 'READERS IN ELEMENTARY SCIENCE AND GEOGRAPHY,'
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ETC.

BOOK I

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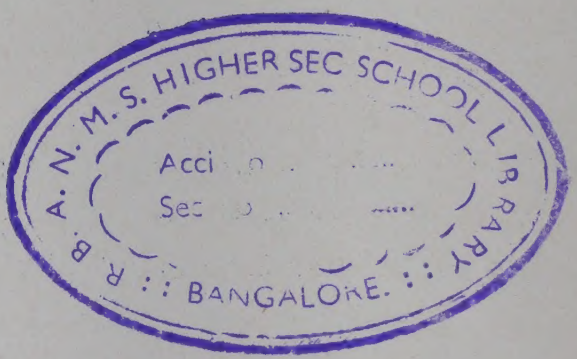

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PREFACE

In these Reading Books, which form the natural complement of the author's Object Lesson Manuals for the Teacher, the great aim has been to meet the children on their own level, and by simplicity of language, simplicity of ideas, and full sympathy with child nature, to arouse new interest in the subject, and so drive home the teaching of the oral lessons.

It cannot be too constantly borne in mind that, at this early age, the child's world is a very small one, and its opportunities for observation extremely limited. Yet all teaching, if it is to be of any use, must begin within these narrow limits. From the known to the unknown is the only safe rule.

Observation of the every-day phenomena of earth, air, and water, and simple experiments, which any child can

perform for itself, are here made the vehicles for conveying new facts; and every care has been taken in so arranging the lessons that they follow on naturally step by step.

The two boys chatting over their lessons at home, and learning to observe things for themselves while out on their rambles with Uncle Tom, will be a healthy example to our young readers, who will readily recall in their sayings and doings, what they themselves have already heard and seen in class.

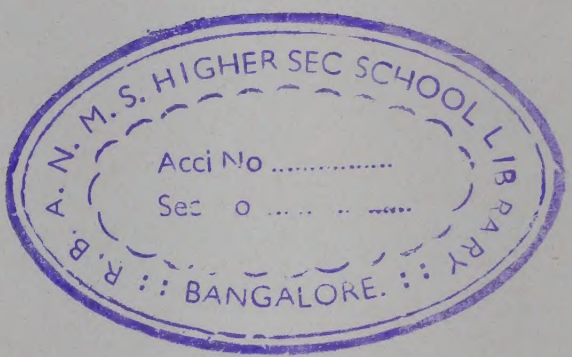
It will be observed that, although the subjects follow the general course of the Teacher's Oral Lessons, the order has been considerably altered. This has been done with the view of avoiding monotony in the character of the successive lessons, and of maintaining as far as possible a general level of attractiveness throughout the book.

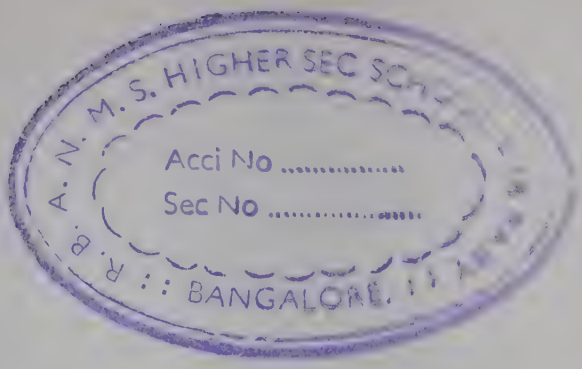
A short summary for recapitulation and committal to memory follows each lesson.

CONTENTS

LESSON		PAGE
1.	About Water	7
2.	Liquids and Solids	10
3.	Things Porous	13
4.	Things that Float	15
5.	The Air	18
6.	The Sky	21
7.	The Sun	24
8.	Hard and Soft Things	28
9.	Sunshine and Shadow	32
10.	A Piece of Clay	35
11.	About Plants	38
12.	Clouds	41
13.	The Wind	45
14.	Clouds and Rain	49
15.	What becomes of the Rain	52
16.	The Roots of Plants	55
17.	Town and Country	60
18.	The Stems of Plants	63
19.	The Cat	67
20.	A Ride in the Train	71
21.	More about the Cat	75
22.	More about the Stems of Plants	79
23.	The Dog	83
24.	Dogs	87
25.	A Spring	92
26.	A Chat about Leaves	96

LESSON		PAGE
27.	The Sheep	101
28.	The Pig	105
29.	About Flowers	108
30.	A River	112
31.	Another Chat about the Sun	116
32.	About the Stars	119
33.	The Weather-Cock	122
34.	About Plans	125
35.	Another Chat about Plans	130
36.	Plans and Maps	133





BOOK I

Lesson I

About Water

'It is jolly in the big boys' school, father,' said Harry Sandys. 'We do all sorts of new things now. Don't we, Dick?'

The two brothers had been in the new school about a week, and of course those left behind in the lower school were very small people indeed now.

'What have you been learning to-day?' asked their father.

'I liked the lesson about water best,' said Dick. 'Teacher filled a saucer up to the brim with sawdust, and then he showed us that he could still keep on piling in more, because the sawdust stood in a heap in the saucer.'

'Then he filled another saucer with water up to the brim, and told Dick to pour in more water from the jug.'

'Of course the water would not stand in a heap,' said Dick. 'As I poured it in from the jug, it ran away over the

edge of the saucer. The top of the water in the saucer still kept quite level.'

'When we slant the jug we cannot make the water slant too,' said Dick. 'It still keeps level, and so it falls over the edge, and pours out into the saucer.'

'Yes,' added Harry. 'That is because

water flows. We saw it flow over the edge of the table at last, and fall down on the floor. Water always flows down.'

'If we dip a brush into water and shake it,' said Dick, 'the water at once breaks up into little round balls or drops. Then if we shake the brush over a saucer, as teacher did, the little drops will run one into the other, and make a pool of water at the bottom.'

'We cannot keep water as we keep most other things,' said Harry. 'We have to put it into a vessel of some sort, or it would flow away.'

'Yes, and then it always takes the shape of the vessel,' said Dick. 'Water has no shape of its own.'

'The water in the saucer was round, because the saucer is round. But teacher poured it into a basin, a jug, and a bottle, and it took the shape of the new vessel each time. Milk, tea, ink, and oil would do just the same, and we call all these things liquids.'

Summary of the Lesson

1. Liquids will not stand in a heap: they flow or spread about, and keep a level surface. They will not slant.
2. Liquids flow down. They flow because they are always trying to reach the lowest level.
3. Liquids break up into drops. The drops run together and unite again when they meet.
4. Liquids have no shape of their own. They take the shape of the vessel which holds them.

Lesson II

Liquids and Solids

'You know we were talking about liquids the other day, father,' said Harry. 'This morning we had a lesson about things that are not liquids. Would you like to hear all about it?'

'Yes, I should,' replied his father.

'Well,' said Harry, 'teacher made us tell him all we could about water and other liquids, and then he put a stone and a piece of wood on the table.'

'We don't keep these things in bottles, you know, for they do not flow away. They stand just where we place them.'

'But if we did put them into any

vessel, they would not spread out, and take the shape of it. They have a shape of their own, and they keep it.'

'We can pick them up in our hands too,' he added, 'for they would not run away between our fingers as water does.'

'Things which we can pick up in our fingers are solids, not liquids.'

'But the last part of the lesson was the best.'

'What was that?' asked his father.

'Teacher showed us how some solids can be changed into liquids,' said Harry. 'He put some wax into one spoon, and some lead into another, and held them over the flame of the gas. We saw them melt into liquids.'

'At first they both stood up in the middle of the spoon, without touching the sides. But when they were liquids, they flowed about like water, and took the shape of the spoon.'

'Yes,' said Dick, 'and when teacher

poured them out, the wax took the shape of the pill-box, and the lead took the shape of the thimble.'

'How did you know that?'

'Because, when the wax and the lead got cool again, they changed back into solids,' said Dick, 'and then teacher turned them out for us to see.'

'It is heat that changes the solids into liquids. It is heat that melts the icicles in the winter time. Ice is solid water, and the heat of the sun changes it into liquid water.'

'Yes, but heat can't melt all solids,' said Harry. 'Brick, wood, stone, and slate cannot be changed into liquids.'

Summary of the Lesson

1. Solid bodies do not flow: they have a shape of their own, and they keep it.
2. Heat changes solids into liquids.
3. Ice is solid water.
4. Melted liquids become solid again when they are left to cool.
5. Some solids do not melt with heat.

Lesson III

Things Porous

One morning the postman brought a letter, to say that Cousin Charlie was coming to spend a few days with our two boys. You may be sure Dick and Harry ran home from school that day, as fast as their legs would carry them.

What a jolly meeting it was too! They had so much to talk about, and so many things to show their little cousin.

After tea they had all sorts of games, till it began to get dark, and then Dick took Harry aside, and with a sly wink said, 'Let us try and catch Charlie; shall we? I have got the sponge ready.'

As he spoke, he filled the saucer with water, and stood the sponge in it.

'Now,' he said, 'take the sponge out of the saucer, Charlie.'

Charlie did so, and then both the boys said, 'What have you done with the water, Charlie? The saucer is empty.'

Charlie was only a little boy, and he looked puzzled, till Dick took the sponge, and squeezed it over the saucer, just as teacher had done in their lesson.

'Oh, I see,' said Charlie, 'all the water went up into the sponge.'

'Yes,' said Dick, 'you see there are little holes all over the sponge. These holes are not on the outside only, but all through it. The sponge is full of holes.'

'These holes are called pores,' added Harry, 'and as the sponge is full of pores, our teacher says it is porous.'

'Then I suppose,' said Charlie, 'the sponge sucks up the water, because it is porous; the water soaks into the holes.'

'Right,' said Dick. 'Water soaks into sand, and the mould in a flower-pot, because these things too are porous.'

'Wait a minute,' said Harry, 'and I will show you something.'

He put a little water in the saucer, and made it red, just as teacher had

done, with a drop or two of red ink. He then stood some pieces of lump sugar, salt, and chalk in this red water.

'Now,' he said, 'you can see the red water rising up through these things. They must be porous, although we cannot see the pores in them. It is only porous things that can suck up water in this way.'

SUMMARY OF THE LESSON.

1. Porous things are full of holes.
2. We cannot see the pores in some porous things.
3. Porous things absorb or suck up liquids.

Lesson IV

THINGS THAT FLOAT

'Come along, Dick, we have got all we want now, so let us begin,' said Harry.

Just then their father came into the garden, and saw little Charlie and the two boys bending over a tub of water.

'You seem very busy, boys,' he said.

'We are only showing Charlie how things float, father,' said Harry. 'Our

lesson to-day was about things that float.'

'Mind you don't spoil your clothes,' he said. 'But what sort of things are you trying to float? 'You can't make everything float, you know.'

'No, father,' said Dick, 'light things float; heavy things sink. You can't make light things sink. They spring up to the top again, if you push them down.'

He was trying to push a flat piece of wood down in the water, just as teacher did, and as he turned to speak to his father, his hand slipped, and he fell with a splash into the middle of the tub.

How Harry and his father laughed, and how Charlie shouted! They made so much noise, that mother came running out, to see what was the matter.

It was lucky that father was there to tell her all about it, for it made her laugh too, and so it was all right for Dick.

When Dick had changed his wet clothes, they sat down for a chat.

'Why do some things float?' asked father.

'The water pushes them up to the top,' said Harry. 'We say the water buoys them up. The lighter a thing is, the higher the water pushes it up.'

'Then why do some things sink?'

'Because they are heavy, and their weight presses downwards, more than the water can press upwards,' said Dick.

'Mud and sand are heavy, for they sink to the bottom, if we put them in water,' said Harry; 'but teacher showed us how to make them float.'

'How do you manage to do that?' asked his father with a smile.

'If we stir the water up, and keep it moving, the mud and the sand will float about in it,' said Harry; 'but as soon as we leave off stirring, and the water becomes still, they sink to the bottom. The sand sinks first, because it is heavier than the mud.'

Summary of the Lesson

1. Light things float in water ; heavy things sink.
2. The lighter the thing is, the higher it floats out of the water.
3. Some things float as long as the water is kept moving, but sink to the bottom when the water is still.
4. Things float because the water presses or buoys them up.

Lesson V

The Air

'We had a lesson to-day about something, which we cannot see, father,' said Dick. 'Guess what it was?'

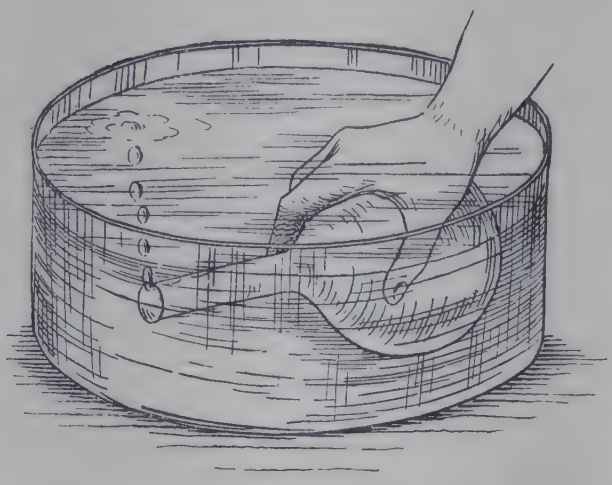
'It was about the air, and of course we cannot see that ; can we?'

'Teacher began by pushing an empty flask, with the mouth downwards, into water. He pushed it right down to the bottom of the bowl, but he could not make the water go up into the flask.'

'He did it though, at last,' said Dick, 'for he slanted the flask, and then we saw bubbles rising up, and some of the water rushed in and filled the flask.'

'The flask was not really empty. It

was full of air, and so there was no room for the water to get in. It was the air from the flask that made those bubbles, and as the air passed out, it made room for the water to enter.'



'Teacher says there is air everywhere,' said Harry. 'He pushed a dry sponge down into the water, and bubbles rose up from the sponge. The water, of course, could not fill up the pores in the sponge, without pushing out the air that was in them. That air made the bubbles.'

'Yes,' said Dick, 'air is a real thing, and though we cannot see it, it is all round us everywhere. We can feel it when we move our hands to and fro, but we do not feel it when we sit still.'

'We do feel it though,' said Harry, 'if teacher waves a fan in front of us, or

blows the bellows in our faces. We feel the air then because it moves.'

'When the air moves it makes other things move too. The bellows moved the air, and the moving air sent the little boat along on the water.'

'You say air is a real thing,' said his father. 'Now all the real things I know, such as stones, wood, clay, water, weigh something. Does air, this other real thing of yours, weigh something too?'

Yes, father, it does,' said both the boys. 'We saw teacher weigh it.'

'Oh, how did he manage that?'

'Well, he closed a big glass flask quite tight,' said Harry, 'and then he found out the weight of it with the scales.'

'Of course, although the flask looked empty, it was really full of air,' added Dick.

'Well, he stood it over the gas flame, and we thought every minute it would burst. But it did not burst. Teacher was driving the air out of it.'

'I can't make out how he did that, but when he weighed the flask again, it was not so heavy. Teacher says the air had been taken out of it.'

SUMMARY OF THE LESSON

1. There is air everywhere although we cannot see it.
2. Air is a real thing and takes up room.
3. Air, like every other thing, has weight.
4. Air can be felt when it is moving about.
5. When air moves it makes other things move.

Lesson VI

THE SKY

'Hip! Hip! Hip! Hooray!' shouted the boys, as they ran home from school.

'We've broken up at last, mother,' said Dick. 'No more school for a whole month. When shall we start?'

The boys were to go back with Charlie to the farm-house in the country, where he lived, and for more than a week they had done nothing but talk about it.

What a time it had seemed to wait for breaking-up day, to be sure! What

a bustle it was, too, for mother at the last to get them ready, and see them off!

They had a long ride in the train, but they got to the end of their journey all safe and sound, and there was Uncle Tom on the platform waiting for them.

'Jump up, boys,' he said, 'we'll soon be home,' and up they scrambled into the big cart, and away trotted old Dobbin along the road to the farm.

They went to bed early that night, for they were tired with their journey,

but the next day uncle took them all out for a ramble through the fields.

They found much to delight them, and after they had walked a long way, Uncle Tom said, 'Let us sit down and rest a little while, boys, for you must be tired.'

'Look at the lovely sky,' said Dick. 'I always think it looks like a large blue basin, placed upside down.'

'It seems to cover the earth all over, like a great round roof,' said Harry, 'and we are under the middle of it.'

'That's very pretty,' said Uncle Tom. 'Do you see the ring all round us, where the sky seems to touch the earth? We call that the ho-ri-zon.'

'What is the sky made of?' asked Dick.

'Why, the sky is only the air, which is all round us everywhere,' said his uncle. 'It stretches up and up, ever so high.'

'But do you know what those white patches are in the sky?'

'Oh yes, uncle,' said Harry. 'They are clouds; rain comes from the clouds.

When it is going to rain, the clouds cover the blue sky and hide it from us.'

'Yes, and they sometimes hide the sun too,' said Uncle Tom. 'It is warm and bright now, because the sun is shining, but when the clouds shut out the sun it is cold and dull. The sun, you know, gives us warmth and light.'

'Yes, and at night, when we cannot see the sun,' said Dick, 'the moon and stars shine in the sky, and give us light.'

Summary of the Lesson

1. The air all round us reaches high above our heads, and forms the sky.
2. The line where the sky seems to touch the earth is called the ho-ri-zon.
3. Clouds float about in the sky. They send us the rain.
4. The sun warms us and gives us light in the day-time.
5. The moon and stars give us light at night.

Lesson VII

The Sun

'Up with the lark in the morning, said Uncle Tom, as the boys went off to bed, 'and I'll show you a very grand

sight.' And so, before daylight they were all trudging away across the fields.

'There,' he said, pointing straight in front of them, 'what do you think of that? Our friend the sun is just getting up. Stand still, and watch the great round ball come up, little by little. We say the sun is rising.'

'I always know where to look for him,' he added, 'for he rises in the same part of the sky every morning. We call that part of the sky the east. We must not look at his bright face long, for it dazzles our eyes. The sun is a great ball of fire.'

'The clouds must be nearer to us than the sun,' said Harry, 'for they sometimes hide him from us altogether.'

'That's quite right, Harry,' said his uncle. 'Sometimes the clouds cover the whole of the sky, but the sun is up there behind them shining just the same.'

'The sun is now very low down, near the ho-ri-zon,' he added, 'but he is not

always low down in the sky like this. In fact, he has been getting higher, ever since we first caught sight of him.'

'Yes' said Dick, 'and we sometimes see the sun very high in the sky.'

'Do you know when the sun is highest?' asked Uncle Tom. 'Well, I will tell you. The sun reaches his highest

point in the sky at twelve o'clock every day. We call that part of the day noon.'

'Then I suppose fore-noon means before twelve o'clock, and after-noon after twelve o'clock,' said Harry.

'Right,' said Uncle Tom. 'Now where do we see the sun in the evening?'

'He is low down in the sky then, near the earth,' said Dick.

'True,' said his uncle, 'but you would not find him then in this part of the sky, which we call the east.'

'Point to the sun now with your right hand, and then stretch out your left hand in a line with it. Your left hand is now

pointing to the part of the sky, where you must look for the sun in the evening. We call that the west.'

'Every day he seems to travel across the sky in a great curve. He is at the top of the curve at noon, and all the afternoon he is getting lower and lower.'

'Then in the evening he sinks down in the west below the ho-ri-zon. We say the sun sets in the west.'

'And now the funny part of it is,' he added, 'that the sun does not move at all. It is our earth that is moving: the sun is quite still.'

'Why, that is just as it was in the train,' said Dick. 'The trees and houses seemed to be flying past us; but of course they were really quite still: it was our train that was moving.'

Summary of the Lesson

1. The sun is a great round ball of fire.
2. The clouds are nearer to us than the sun.
3. The sun rises in the east every morning, and sets in the west every evening.
4. The sun is at its highest point in the sky at noon.

Lesson VIII

Hard and Soft Things

'How would you tell hard things from soft, Charlie?' asked his cousin Harry.

'Why, anybody could tell that,' replied

Charlie. 'You have only to squeeze them.'

'Ah, but some of the things, which we might call hard, when we squeeze them, are really soft after all,' said Harry. 'Our teacher says we can only tell whether a thing is really hard or soft, when we compare it with something else.'

'Yes,' added Dick, 'we can squeeze a piece of clay in our hands, but we can't squeeze wood, and so we say clay is soft and wood hard.'

'But then we can drive a nail into the wood, and that tells us that the wood is soft and the iron nail hard.'

'We can tell hard things from soft by scratching them,' said Harry. 'Some things are so soft that we can scratch them, and even pick pieces out with our finger-nail. But we cannot make the least mark on things that are hard.'

'Teacher showed us a better way than that, though,' said Dick. 'He gave us a knife, and set us to cut things with it.'

'I can cut lead with my knife, because the steel knife is hard and the lead soft.'

'All this is very good,' said his uncle. 'We always use hard things to cut soft ones. Suppose you take your knife now and cut me off a piece of this glass.'

'You cannot do it, you see. You cannot even scratch the glass with the knife; but I can scratch the knife with the glass.'

'What do you say now, boys?'

'The glass must be harder than the steel,' they both replied.

'How did the man cut the glass, when he mended the window-pane?'

'He cut it with a diamond,' said Dick.

'Yes,' added Harry, 'and diamond is the hardest thing known. Flint is very hard. You can scratch glass with a flint, but it will not cut the glass.'

'Do you know how to tell hard things from soft by rubbing them together?' asked Uncle Tom.

'Yes,' replied both the boys, 'the hard

thing scratches, marks, and cuts the soft one. Teacher showed us this with a rasp and a file. These tools rub off little pieces of wood, lead, and iron, because they are hard and those things are soft.'

'Glass is hard and chalk soft; yet I can break them in pieces with a hammer,' said their uncle. 'Iron is hard and cork soft; but I cannot break either of them. What does all this mean?'

'Glass and chalk break easily, because they are brittle,' replied Dick. 'Glass is hard and brittle, chalk is soft and brittle. Iron and cork are tough bodies. Iron is hard and tough, cork is soft and tough.'

Summary of the Lesson

1. Soft things yield when we squeeze them; hard things do not yield.
2. Some things are so soft that we can scratch them with our nail; some are so hard that we cannot scratch them with the sharpest steel knife.
3. Hard things will scratch softer things.
4. Diamond is the hardest substance known.
5. Things which break easily are brittle.
6. Things which do not readily break are tough.

Lesson IX

Sunshine and Shadow

'Don't stand out there in the hot sun, my boys,' said Uncle Tom. 'It is much nicer and cooler in the shade.'

'What makes the shade?' asked Dick.

'Well, you see,' he replied, 'when the sun shines on trees or walls, the light cannot pass through them, and so it throws a dark patch on the ground. This dark patch is a shade or a shadow.'

'Go and stand where you were standing just now,' he added.

'Why, that must be my shadow on the ground,' said Dick.

'Of course it is,' said Uncle Tom. 'The sun cannot shine through your body, and so it casts a shadow.'

'Why is it cool as well as shady under a tree, uncle?' asked Harry.

'It is cool as well as shady there,' said his uncle, 'because the heat of the sun, as well as its bright light, is shut off.'

'It is just noon or twelve o'clock now,' he added, 'and you know the sun is always at its highest point in the sky at noon. Stand still, and I will measure the length of your shadow on the ground.'

'There, that will do,' he went on. 'Now, I want you to amuse yourselves this afternoon by taking the measure of each other's shadow from time to time.'

Evening came, and Uncle Tom said, 'Well, boys, what about the shadows?'

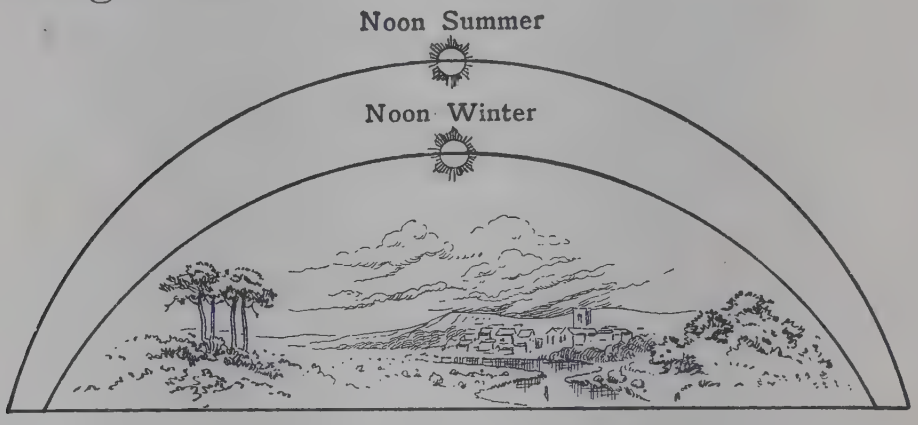
'We took the measure ever so many times, uncle,' said Dick, 'but each time it was longer than it was before, and we were very careful to measure it right.'

'Yes, my boy, your measure was all right,' said Uncle Tom. 'The shadows grew longer, because the sun was getting lower in the sky all the afternoon.'

'At noon, when the sun was high up above our heads, it cast short shadows,' he added, 'but just before sunset, when the sun was low down, it shone full on your body, and so threw a long shadow.'

'If you look for the noon-day sun in winter, you will find it is not nearly so high in the sky, as it was at noon to-day. What sort of shadows will you expect to see then?'

'They will be long shadows, uncle,' said Harry, 'because the sun will not be so high then.'



'Quite right, my lad,' said Uncle Tom; 'and now I don't think you will forget that short shadows mean long days, and long shadows short days.'

'The sun mounts higher at noon in the summer than it does in the winter; and it rises much earlier and sets much later. The days are longer and warmer in summer than in winter.'

SUMMARY OF THE LESSON

1. Bodies, through which the light cannot pass, cast shadows on the ground.

2. When the sun is low in the sky the shadows are long; when the sun is high the shadows are short.

3. The noon shadows in summer are shorter than they are in winter.

4. The sun rises earlier and sets later in the summer than in the winter, and it also mounts higher in the sky at noon.

5. That is why the days are longer and warmer in the summer than in the winter.

Lesson X

A PIECE OF CLAY

'Look here, Charlie,' said Dick, 'do you know where this came from?'

'Yes,' said Charlie, 'it is a lump of clay, and clay is dug out of the ground.'

'Our teacher calls clay a mineral, because it is found in the earth,' said Harry. 'Put it into this pail of water.'

'Doesn't it feel heavy!' said Charlie.

'Yes, it is heavy,' said Dick. 'See, it has sunk to the bottom of the water. Heavy things always sink, you know.'

'Wait a minute, boys,' said Uncle Tom, who had just come up. 'Let us

take the clay out of the water now, and see what we can learn about it.'

'How smooth and soft it feels! Look, I can easily squeeze it up in my hands, and cut pieces off it with the knife.'

'But,' he added, 'I can also beat it with the hammer, and drop it on the ground, without any fear of breaking it.'

'This tells us that the clay is tough, as well as soft,' said both boys.

'See; I can make all sorts of things with it. This would do for a saucer; now I will break up the saucer, and mould the clay into a basin,' he said.

'Oh yes,' said Harry, 'teacher told us that things, which can be moulded into all sorts of shapes like this, are said to be plastic. Clay is plastic.'

Uncle Tom then filled the little clay basin with water.

'What do you notice?' he asked.

'None of the water soaks through the clay,' said Dick.

'Then what do we learn from this?'

'The clay is not porous,' they replied.

'Quite right,' said their uncle. 'Now look at this other piece of clay. You see it is dry clay, and it feels hard when we touch it. But if I tap it with the hammer, it breaks easily; it is brittle, not tough.'

'I will now pour some water on this dry clay. See, the clay sucks it up.'

'Dry clay must be porous then,' replied the boys, 'for it is only porous things that can suck up water.'

'Yes, it is,' said their uncle. 'Let us put this piece into the water now.'

After a while, he took the clay out of the water again, and then the boys found that it was no longer hard and brittle. It had sucked up enough water to fill its pores, and it was now soft, tough, and plastic, like the other clay.

He made a little basin with it, and filled the basin with water, but none of the water ran away. The clay was no longer porous as it was when dry.

Summary of the Lesson

1. Clay is a mineral, because it is dug out of the earth.
2. Clay is heavy, soft, tough, plastic, and not porous.
3. When clay is dry it becomes hard, brittle, and porous.
4. Dry clay will absorb water till its pores are full; but after that it will not take in any more.

Lesson XI

About Plants

'Just look there, Dick. What do you think of that?' said Harry, as Cousin Maude came up the garden with a great bunch of fresh-cut flowers in her hands.

'They are lovely,' said Dick. 'I am so fond of flowers.'

'Well, boys,' she said, 'my garden work is done for to-day. Suppose we have a chat about the flowers now.'

'That will be splendid,' cried the boys.

Maude was the eldest of the family at the farm-house. The younger children all looked up to her, for she was so clever, and knew so much about things.

'I think every one must love flowers,' she said, spreading them out on the

table as she spoke, 'they are so beautiful. Look at them. They are white, red, yellow, blue, pink — all sorts of colours, and all sorts of shapes.'

'How soft and smooth and tender

they are too,' she added. 'The least rough handling would bruise them.'

'Run and get some water to put them in, Ella, or they will die,' she added.

'What, do you mean to say they are alive?' said Dick.

'Yes, Dick,' replied Maude, 'all the

flowers in the garden are living things. They live and grow in the ground.'

'Let us walk down the garden, and look at some of those living things.'

'Here is one. Do you see anything else on it besides flowers?'

'Oh yes,' said Harry, 'there are leaves as well as flowers.'

'Of course,' she replied; 'and you see the leaves on this one are not the same shape as those on the next, although they are all the same colour—green.'

'The leaves grow on stalks, and the stalks come from the stem, which springs up out of the ground.'

'So, you see, these living things are made up of many parts,' and, as she spoke, she pulled one of them up and shook it against the gate-post.

'Here is another part,' she said, 'which we could not see before, for it was in the ground. It is the root.'

'All things that live and grow in the ground are plants. Our pretty garden

flowers are plants; the green grass and the great tall trees are plants too.'

'The root holds the plant firmly in the soil. But it does more than that. As the plant is a living thing, it must have food, or it would die. The root finds food for the plant in the soil.'

SUMMARY OF THE LESSON

1. Things which live and grow in the ground are called plants.
2. Plants have several distinct parts, and one part is not at all like another.
3. The root feeds the plant with food, which it sucks up out of the soil.
4. The root holds the plant firmly in the ground.

Lesson XII

CLOUDS

'What a change! It is set in for a wet day, boys,' said Uncle Tom, 'so we must make ourselves cosy indoors.'

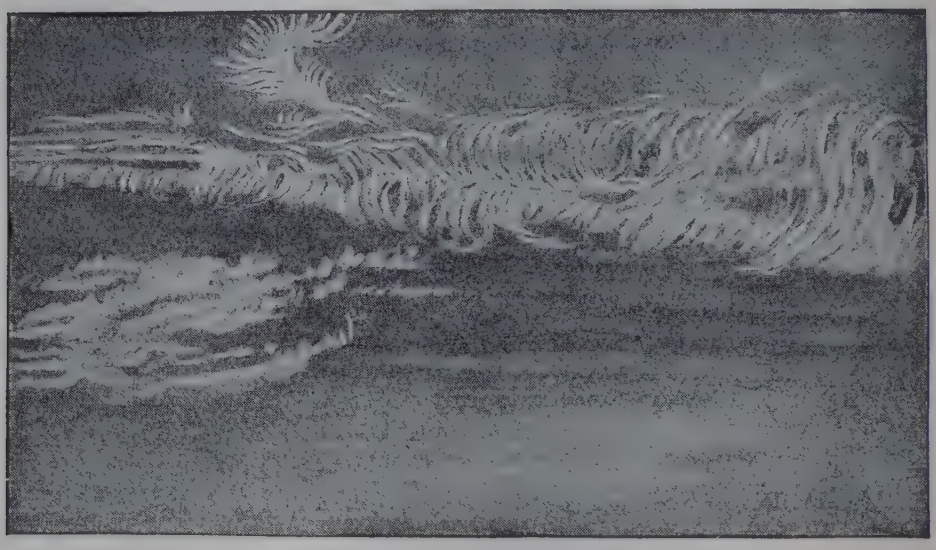
'Isn't it coming down!' said Dick, looking out of the window. 'The sky is covered with thick clouds now, uncle.'

'Sometimes we see only little white patches of cloud, dotted over the blue

sky. They look to me like loose white wool or feathers.'

'So they do,' said his uncle; 'and they are often called feather clouds.'

'I like to watch those great curly



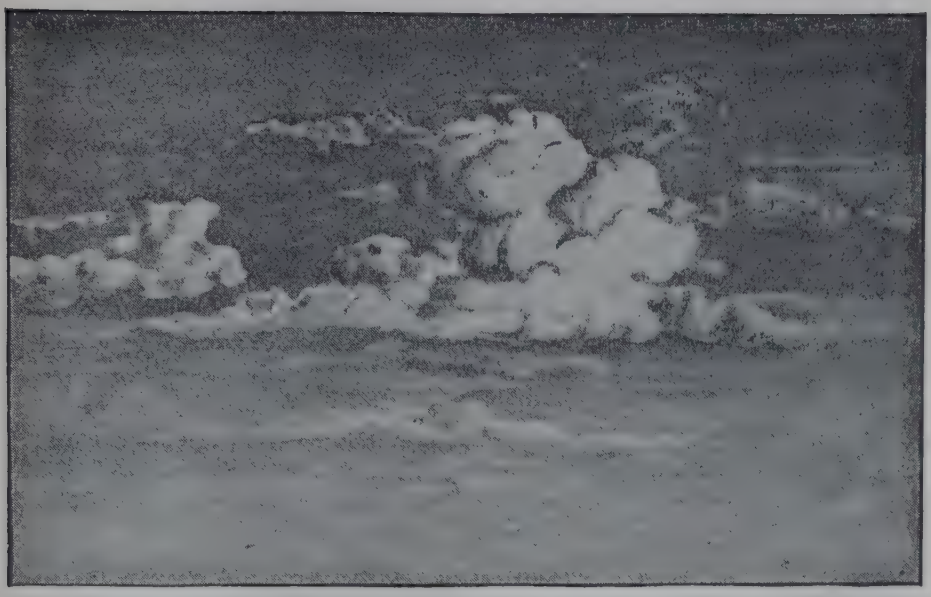
FEATHER CLOUDS.

masses of thick clouds, which are sometimes piled up in the sky,' said Harry.

'Ah, they are called heap clouds,' said his uncle, 'and when the sun breaks through them, they do look grand.'

'Sometimes, too, the clouds are not piled up in curly masses, but stretch across the sky, low down, in beds or layers.'

'Those are known as layer clouds.'



HEAP CLOUDS.

'What are the clouds made of, uncle?'

LAYER CLOUDS.

'I will show you,' he said. 'The kettle is singing on the hob. Let us

put it on the fire. There, what do you see now coming out of the spout?'

'Oh, that is steam,' they both said.

'So it is,' said Uncle Tom. 'It is really a little cloud. The heat of the fire has changed the water into a cloud of steam.'

STORM CLOUDS.

'Take this wet plate, and hold it in front of the fire. The heat of the fire is making another little cloud.'

'What would happen if we stood the wet plate out in the hot sun?'

'The plate would soon get dry.'

'Yes, it would get dry, because the

heat of the sun would change the water on it into a little cloud, and the cloud would float away as this one does,' said Uncle Tom.

'And now, can you tell me why the cloud floats away?'

'I suppose the cloud is lighter than air,' said Dick, 'light things always float.'

'Yes,' said his uncle, 'the cloud is so light that the heavy air forces it up. That is the reason why all the clouds float in the sky.'

Summary of the Lesson

1. There are feather clouds, heap clouds, layer clouds, and storm clouds.
2. Heat changes water into cloud.
3. Clouds float in the sky because they are lighter than the air.
4. The heavy air presses the light cloud upward.

Lesson XIII

The Wind

'This is a rough day, and no mistake,' said Uncle Tom. 'Hark! how the wind roars and howls round the house. There will be no going out to-day, boys.'

Harry and Dick were standing with their uncle at the window as he spoke.

'Oh uncle, do look at that great tree,' said Harry. 'See, it is swaying to and fro, and bending over from side to side.'

'How funny it is,' said Dick, 'for we cannot see anything touch the tree.'

Before he had done speaking, they all three burst into a loud hearty laugh.

They had been watching a man in the road for some time, and they could see what hard work he had to keep his feet.

Then, all of a sudden, something seemed to snatch his hat off his head,

and away it went bowling and trundling down the road, and the poor man after it.

The faster he ran, the faster the hat seemed to fly along.

'Our friend in the road can feel the wind, although he cannot see it,' said Uncle Tom, laughing louder than ever.

'I have been thinking about the wind all this time, uncle,' said Dick. 'Is the wind only the air moving about?'

'That's all it is, my lad. What made you think so?' asked his uncle.

'Because, in one of our lessons about air, teacher puffed the bellows in my face, and though we can't see or feel the air while it is still, I could feel it then.'

'Teacher puffed the bellows against a little boat in a tub, and made it move along on the water.'

'Yes, Dick,' said his uncle, 'the bellows made the air move, and the moving air was a wind. It was that wind which blew your boat along.'

'But how is the real wind made, uncle? There can't be any bellows big enough to make a wind like that.'

'No, my lad, our friend the sun does it all,' said his uncle.

'When the sun shines, it makes the air very hot. As the air gets hot, it also

gets light, and then the cold, heavy air near it pushes it aside, and makes it rise. The warm air rises, because the cold air near it pushes it up. It is this cold, heavy air pressing the warm, light air away, which makes the wind.

SUMMARY OF THE LESSON

1. Wind is moving air. We can feel it, although we cannot see it.

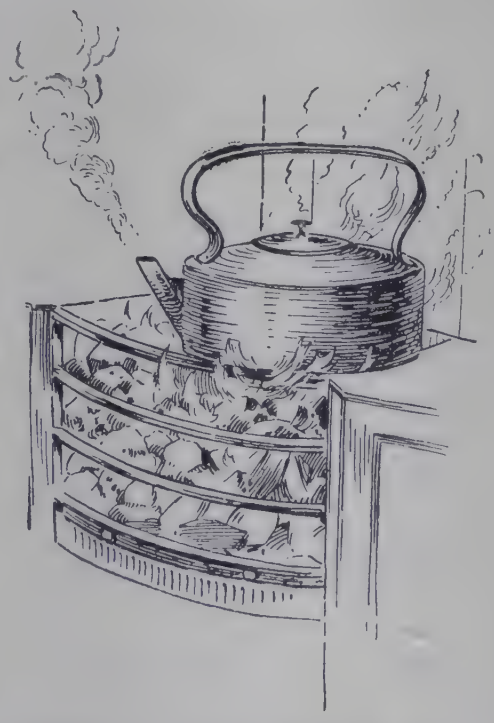
2. Warm air rises because it is lighter than cold air. The cold, heavy air forces it up.

3. When the air moves it makes other things move. We say the wind blows them.

Lesson XIV

CLOUDS AND RAIN

'Are all the clouds in the sky made of steam, like the steam that comes out of the kettle, Maude?' asked her little sister Ella. 'Dick says they are.'



'So they are,' said Dick. 'Uncle told us that the steam, which comes from the kettle, is a real little cloud.'

'Ah, wait a bit, Dick,' said his cousin Maude. 'Take this slate, and hold it close up against the little cloud, which is puffing out of the spout of the kettle.'

'The slate is wet,' he replied at once. 'There are little round drops of water rolling down it, and of course the water must have come from the steam.'

'So it did,' said Maude, 'and yet that white cloud, which you see, is not steam. Look; we cannot see the real steam, when it first puffs out of the spout.'

'We do not see it, till it begins to change back into water. Then it forms a white cloud, some distance from the spout. This we call vapour — water vapour.'

'The air of the room is not so cold as the slate. It could not change the steam into drops of water at once, as the slate did. But it is cold enough to make it begin to change, and in that state it forms a white cloud of water vapour.'

'The heat of the sun changes water everywhere into vapour like this, and it is water vapour—not steam—that rises in the air to form clouds.'

'When this vapour of the clouds gets

cold, it changes into drops of real water. Then it must sink to the earth again, because water is heavier than the air. It cannot float in the air as vapour does.'

'I caught some rain-drops on a dusty board, when it was raining, and watched them roll about in the dust,' said Ella. 'They look like little round balls of water, and they do sparkle in the sun.'

'Ah, that reminds me of something else,' said Maude. 'You have all seen a rainbow in the sky. It is the sun shining on the drops of rain, as they fall, that makes those beautiful colours in the rainbow. It is because every little rain-drop is a round ball of water, that the bow itself is curved or round.'

'There is just one thing more,' she added. 'You have seen the big clouds chasing one another across the sky. Do you know what makes them move?'

'It is the wind that blows them along from one part of the sky to another.

This is a good thing, you see, for the rain does not all fall in one place.'

Summary of the Lesson

1. Vapour changes again into drops of water when it gets cold.
2. Water is heavier than air. The drops of water cannot float in the air. They fall as rain.
3. Rainbows are formed by the sun shining on the round drops of rain, as they fall from the clouds.
4. The wind blows the clouds about from one part of the sky to another. Hence the rain does not all fall in one place.

Lesson XV

What Becomes of the Rain

'It's all over now,' said Charlie. 'It was only a shower; but didn't it come down while it lasted! Let us get our boats. We can have some fun now.'

When the boys went out, the water was rushing along in a stream by the side of the road. It carried their boats along at a rapid rate.

'Why does the water run along so fast?' asked Charlie.

'Water always flows down,' said Harry, 'and it flows quickly here, because the road is on the slope. It will all flow away soon, and leave the gutter dry.'

They were still busy with their boats,

when Uncle Tom came along, and so they all walked back together. On their way they pointed out to him the great puddles in the road.

'Ah,' said he, 'we shall see very little of them in an hour or two. The road will soon be quite dry.'

This set the boys thinking, and Dick said, 'Oh, I know, uncle. The earth is porous. The water will all soak in.'

'Well, you are not quite right,' he replied. 'Some of it will soak into the porous ground, but not all.'

'Then what will happen to the rest?' asked both the boys.

The sun was now streaming down, and the air was quite warm, and Uncle Tom pointed this out to them.

'Oh,' said Dick. 'You mean that the sun will change some of the water into vapour, uncle. The vapour will float up in the air to form clouds.'

'Yes,' said his uncle, 'the road will get dry, just as the wet clothes on the line get dry. The water that makes them wet changes into vapour, and is sucked up by the air.'

'The hot sun makes the air very dry,' he added, 'and the drier the air is, the more quickly it sucks up vapour.'

'Sometimes the clothes on the line,

and the roadways after the rain, remain wet for a long while. The air is then so full of moisture, that it can hold no more.'

'The air, in fact, is something like a sponge,' he said. 'If you stand a dry sponge in a saucer of water, it will quickly suck it all up, and leave the saucer dry. But if the sponge is so wet, that it cannot hold any more, all the water will remain in the saucer.'

Summary of the Lesson

1. Some of the rain flows away in streams down the side of the road.
2. Some of it sinks into the earth.
3. Some of it changes into vapour, and floats away in the air to form clouds.
4. When the air is very dry it sucks up water vapour very quickly.

Lesson XVI

The Roots of Plants

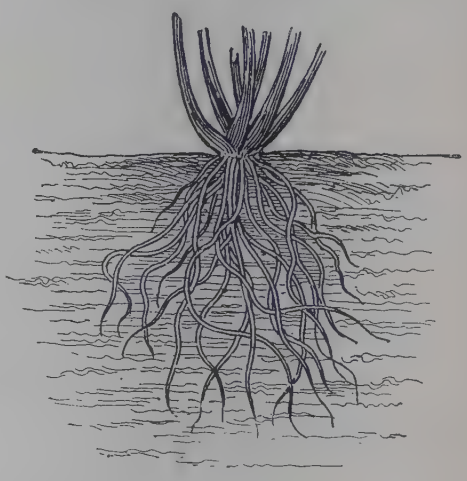
'I wish, Maude, you would tell us something about roots, and how they feed the plant from the soil,' said Dick.

'Very well,' said his cousin, 'we will have a chat about the roots, if you like. But the root has other work to do besides feeding the plant, you know, Dick.'

'Yes,' said Harry, 'the root holds the plant firmly in the soil, and keeps it from being torn up by the rough winds.'

'Well, let us look at some roots now,' she said, pulling up a plant as she spoke.

'I will shake the root clear of the soil. Now, what does it look like?'



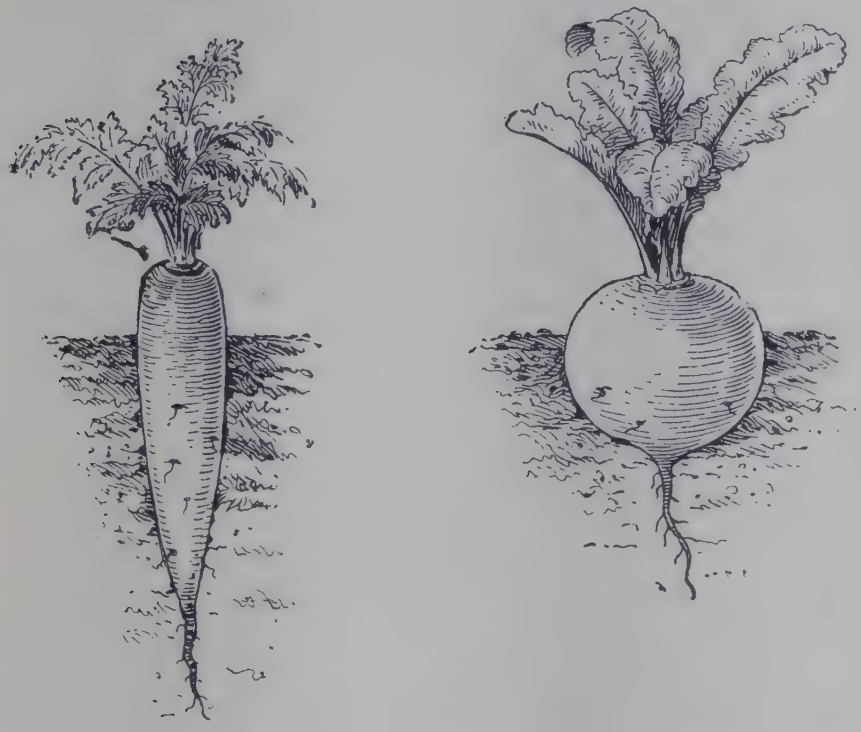
'It looks like a lot of dirty white threads or strings,' said Dick.

'Yes,' said Ella, 'and that is why we call it a fibrous root. Isn't it, Maude? Fibre means a thread or a string.'

'Ella is quite right,' said Maude. 'Now all the plants in this bed came from seeds, which I sowed in the spring. They will die down when winter comes.'

'All plants, that live for one season only, have fibrous roots like this. Now come with me into the kitchen garden.'

'These roots are not made up of strings



or fibres, you see,' she said, as she pulled up a carrot and a turnip. 'They are all in one piece. They are not fibrous roots.'

'Look, if I cut the carrot across, you can see that it is thick, solid, and fleshy all through. We call it a fleshy root.'

'How strange,' said Dick. 'Why do some plants want thick fleshy roots?'

'I will tell you,' said Cousin Maude. 'If I sow carrot seeds in the spring, young carrot plants grow up from them. These plants grow all the season, but when winter comes round they do not die, as many other plants do. Their green tops die down, but the thick root remains alive in the ground all the winter. Then when spring returns these plants wake up out of their winter sleep, and begin to send out fresh green leaves.'

'See what I have here. About three weeks ago I cut off the top of a carrot, and stood it in this saucer of water. A week later I did the same with another, and a week later still I put in this one.'

'You see they are all growing. The first has grown quite a big top. Now these things can't grow without food, and water alone won't feed them. How then did they get their food?'

'The green stalks and leaves are taking their food from the carrot itself. See, the more they grow the more the carrot seems to shrivel up.'

'These large fleshy roots contain a store of food to feed the plant, when it begins to grow again, because it cannot then get its proper food from the soil.'

'The parsnip, radish, and beet are fleshy roots like the carrot and turnip.'

Summary of the Lesson

1. Plants which live only one season have fibrous roots.
2. Some plants have thick fleshy roots ; they live for more than one year.
3. All these fleshy roots contain a store of food to feed the plant when it cannot get its proper food from the soil.

Lesson XVII

Town and Country

Ella had never been away from the farm, the green fields, and the country lanes. She often thought about the great town, where her cousins lived.

One morning she said, 'What a strange place your big town must be, boys. Do tell me something about it, please.'

'Well,' said Dick, 'think of this dear old farm-house standing all by itself, in the midst of the fields. You have to go ever so far, before you see any other houses, and even in the village, you find only a few cottages here and there.'

'Then think what it must be to see

thousands of houses, packed close together on both sides of the road, so that you can walk for miles between them. That is what a town is like.'

'Those rows of houses form streets and roads. In the wide roads the houses are large, and there are churches and other great buildings, as well as hundreds of fine great shops.'

'What can they want with all those shops?' asked Ella. 'There are only two shops in our village.'

'And yet in all those shops,' said Harry, 'they are busy serving from morning till night, for the people are coming and going all day long.'

'Where do all the people come from?' she asked.

'I think I can give Ella a surprise,' said Harry. 'You know there is one little school in your village, Ella, with just a few boys and girls in it. Well, in our town there are so many schools, that you can't go far without seeing one, and

in most of them you would find more than a thousand children.'

'More than a thousand children in one school,' cried Ella; and then, after she had thought again, she asked, 'Why are there so many people in the towns?'

'Our teacher says people live in the towns, because their work is in the towns,' replied Dick. 'It does not take many people to do the work on the farms here. That is the reason why there are so few people in a village.'

'But in the towns there are ever so many great mills and workshops, where thousands of people work all day long.'

'Ella would think the town a busy place,' said Harry, 'if she could watch the tram-cars, 'buses, cabs, carts, and waggons in the roads. There are so many of them, and they keep coming and going so fast one after another, that people who are walking have to wait ever so long, before they can cross the

road. And what a noise and rattle they all make, too, as they roll along.'

'Yes,' said Dick, 'and they don't stop running when it gets dark. The roads are all lighted up then. It is almost as light as day. It is a fine sight to see the street lamps all lighted up at night.'

Summary of the Lesson

1. A town consists of roads and streets packed close with houses and shops. It has its market-places, as well as schools, churches, and other large buildings.
2. People live in the town, because their work is in the town.
3. Some towns contain large mills and workshops, and thousands of people are busy in them all day long.
4. A village consists of a few houses and shops, with a church and a school.
5. Only a few people live in the village, because there are no large works there. Farm work does not require many people.

Lesson XVIII

The Stems of Plants

'We have found out something about the stems of plants, Maude,' said Dick.

'Well, what have you found out, boys?' asked Maude.

'Some are hard, almost like wood; others are green and soft,' said Dick.

'Yes, those hard strong stems are not only like wood, they are really wood,' said Maude. 'They have to be hard and strong, for they do not die down when the winter comes; they live on for many years. All trees and bushes have woody stems.'

'Those green stems all die down to the ground in the winter. Either the plant itself dies altogether at the end of the season, or the stem dies, and only the part in the ground remains alive, to send up a new green stem the next spring.'

'All plants, which have green stems like these, are called herbs.'

'Some of those green stems can stand upright by themselves,' said Harry, 'but others are tied up to sticks.'

'Yes,' she said, 'all the plants, that are trained to sticks, have weak slender stems. They could not hold themselves up without a stick to support them.'

'Here is one—the bindweed, and here is another—the hop. They both twine themselves round the sticks, and so we call them twining stems.'

'It is very strange, too, that each of these stems twines in its own way. If

BINDWEED.

HOP.

we tried to force either of them round the other way, it would be sure to go back, when it was left to itself.'

'Now look at this sweet-pea. It wants a stick, you see, to support it, but it does not twine. These little curling

tendrils cling to the stick like so many fingers. All plants, which cling to other things by means of tendrils, are called climbing plants.'

SWEET-PEA.

'Now look at these long slender stems of the strawberry plants. They run along the ground, and are called runners.'

'A little plant forms at the end of the runner, and sends its roots down into the soil.'

'The name straw-berry is really stray-

STRAW-BERRY.

berry. It means that the plant strays, or runs along the ground.'

'Smell the leaves of this plant,' she added. 'It is mint. Let us dig it up, and see what we can learn about it.'

'Look at those long white cords. They are stems, and they grow in very much the same way, as the runners of the strawberry plant do. But they make their way under the ground, not along the surface.'

'We call them creeping plants. Their stems creep along under the ground.'

Summary of the Lesson

1. Plants that live only one season have soft green stems.
2. The stems of trees, shrubs, and bushes, which live year after year, are hard and woody.
3. Most plants with slender stems twine or climb round other things for support.
4. Some others run along the surface of the ground with runners.
5. Some creep along under the ground.

Lesson XIX

The Cat

'Here is pussy coming to meet us,' said Ella. 'Do you notice how glad she is to see us? When she carries her tail stiff, and almost upright like that, it is her way of telling us that she is pleased.'

'Do you hear her singing, or purring, while she rubs her head against my hand? That too is to show us how pleased she is.'

'Rough boys sometimes teaze the cat,

and then she lashes her tail from side to side, and looks very fierce.'

'Cats often lash their tails when a strange dog comes near them,' said Dick. 'I suppose that is because they are afraid of dogs.'

'Yes,' replied Ella, 'Maude says cats

lash their tails when they are angry, and when anything frightens them.'

'Poor puss,' said Harry, stroking her as he spoke. 'What a lovely soft coat she has. It must be warm and cosy.'

'Yes, it is made of thick soft glossy fur,' said Ella. 'Puss never lets it get matted or dirty, but she will not go near the water to wash herself, for cats do not like water on their fur. She washes it with her tongue and paws.'

'Give her this saucer of milk,' said Maude. 'There, do you see how she drinks it? She laps the milk up with her long tongue.'

'Notice how sharp she is at hearing,' she said, as puss pricked up her ears to listen. 'Those erect, wide-open ears can catch the least sound.'

'Come here, puss,' she added, taking the cat on her lap as she spoke. 'Let me show the children your eyes next.'

'Do you see that long narrow slit down the middle of pussy's eye? That

is called the pupil of the eye. There is a pupil in your eye too, but it is a round black spot, not a long slit like this.'

'I once found our cat in the cellar, all in the dark,' said Dick, 'and her eyes gave me quite a start, for they looked like two round blazing balls of fire then.'

'Ah,' said Maude, 'that will help me

to explain. When the sun is shining into our windows, we pull down the blind, to shut out some of the light.'

'That is just what happens to the cat's eyes. The light is now very bright, and so the pupil closes up into a narrow slit. When Dick saw the cat in the dark cellar, the pupil of her eye was wide open, to get all the light it could.

Cats can see well, where we should be groping about in the dark.'

'But,' she added, 'the strangest thing is that cats can feel their way along with their whiskers, or feelers, when it is too dark even for them to see.'

SUMMARY OF THE LESSON

1. The cat has a warm coat of fur, and a long tail.
2. The cat shows whether it is angry or pleased by means of its tail.
3. The cat laps its drink with its tongue.
4. Its ears are very sharp, and its eyes are made to see well, when it is too dark for most other animals to see at all.
5. The feelers serve instead of eyes when it is very dark.

Lesson XX

A RIDE IN THE TRAIN

'Are you all in?' asked Uncle Tom, as he stood by the door of the railway carriage. 'That's right; then I may as well get in too, or I shall be left behind.'

They were going out for the day—uncle and aunt and all the children. Uncle Tom had no sooner got in and shut the door, than the engine gave a shrill whistle, and away they went.

'Come and stand by the door, and look out, boys,' he said. 'Our part of the country, you know, is very flat. The open fields stretch away on both sides of us, as far as our eyes can reach.'

'This flat level land is called a plain.'

After a long time the boys began to notice a change. The land on both sides of them seemed to be rising little by little, till at last it was much higher than the train itself.

They could no longer see the green fields now. They seemed to be shut in by a high bank on each side.

'See, uncle,' said Dick, 'those high banks look just like chalk.'

'Yes, Dick, and they look what they are,' said his uncle, 'for they are really made of chalk. This part of the railroad has been cut through the chalk. We call it a cutting.'

'Why was the road cut through the chalk like this?' Dick asked again. But before his uncle could reply, the engine

gave a shrill scream, and all of a sudden they found themselves in darkness.

They could hear the train still rushing on, for it made more noise than ever now, but they could see nothing.

Dick and Harry crept up closer to their uncle in the darkness, half afraid that something dreadful was going to happen. But after two or three minutes the light began to come again, the train made less noise, and they soon found themselves in the open air once more.

'What was it, uncle?' asked Harry in a whisper.

'We have passed through a tunnel, that's all,' said he.

'But what is a tunnel?'

'A tunnel is a long hole cut through the earth,' said his uncle. 'When we were in the tunnel just now, we had a great mass of earth, hundreds and hundreds of feet high above us. The tunnel is a road cut through this earth.'

'Land, which rises up in a high mass many hundreds of feet above the level country all round, is called a hill.'

'Notice, too, how the land slopes down and forms hollow places between the hills,' he added. 'These hollow places between the hills are called valleys.'

Summary of the Lesson

1. A plain is flat level land.
2. A hill is a mass of land which rises many hundreds of feet above the level country all round.
3. A valley is a low hollow place between two hills.
4. A small valley is called a vale or a dale.

Lesson XXI

More about the Cat

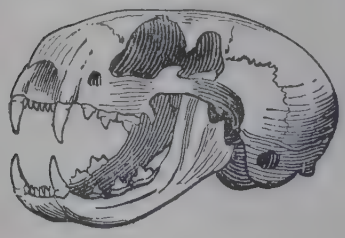
'Oh, you bad pussy,' said Ella. 'Look, Maude, she has caught that poor little bird, and now she is tearing it to pieces and eating it up. How fierce she looks

too! I don't mind her catching the mice, but I wish she wouldn't kill the little birds.'

'Ah,' said Maude, 'puss is very gentle to play with, but let me show you why she kills and eats other animals.'

'Look at her now while she is yawning after her meal. What a wide mouth

she has, and what teeth! There are six small sharp teeth in front of each jaw, and on either side of these there is one very long curved pointed tooth. Then behind these again there are other large teeth with very sharp edges.'



'The four long teeth are really meant to seize and tear the mice and birds.'

'We move our jaw from side to side, as well as up and down, when we eat. But the cat can move her jaw only one way—up and down—and the teeth cut like the edges of a pair of scissors. The cat's jaws and teeth are made for cutting and chopping flesh, not for chewing.'

'Here, let her lap a little milk out of your hand, Dick,' she added.

'Her tongue feels rough,' said Dick.

'Yes,' replied Maude, 'the cat's tongue

is set with small, sharp, horny points, which stretch backwards. She uses her tongue to strip the flesh from the bones.'

'Now look at her feet,' she said, taking the cat up in her lap as she spoke. 'The front paws have five toes; the hind ones four. Puss walks on her toes, not on the sole of her foot, as we do. Then besides that there are soft pads on the under side of the paws.'

'Oh, I see,' said Ella, 'if the cat's feet made a noise, the mice would hear her. So she has soft smooth pads to walk on.'

'Yes,' said her sister, 'and she is not only able to tread lightly and softly, but her legs are also made on purpose for leaping and springing.'

'If we took puss up when she was angry, we should see that each toe is armed with a strong, curved, pointed

claw. We don't see them now; she has them drawn up in a sheath. She only stretches them out, when she is angry.'

'Those sharp claws, I suppose, help her to seize the mouse or the bird, when she springs upon it,' said Ella.

'Yes,' replied Maude; 'and they are also a great help to her in climbing. Cats, you know, are splendid climbers.'

'The cat's teeth, you see, show that she was meant to be a flesh-eater. But she must catch her food before she can eat it, and so her body, legs, and feet fit her for hunting. She has to hunt the mice and other animals at night, and so her ears, eyes, and whiskers, as well as her warm coat, fit her for prowling about at night. Lions and tigers are immense wild cats.'

SUMMARY OF THE LESSON

1. The cat is a killing animal; it is formed to kill.
2. The teeth act like the edges of a pair of scissors.
3. The jaw has only an up-and-down movement.
4. The tongue is rough. The cat scrapes the flesh off a bone by licking it with this rough tongue.
5. The cat is formed for night prowling. All cats are good climbers.
6. The feet are padded, and the claws can be drawn back in their sheaths.
7. Lions and tigers are immense cats.

Lesson XXII

MORE ABOUT THE STEMS OF PLANTS

'Here is a great thick root, Dick,' said Harry. 'I nearly cut it with the spade.'

'Ah,' said Maude, looking round, 'your spade has struck against an underground stem, not a root.'

'There,' she added, when she had cleared away the soil round it, 'this is the underground stem of the common iris or flag. It is very

IRIS.

much like a root, I know, but it is really a stem.'

She pointed out the buds here and there on the sides of it, and then she told the boys that buds never grow on roots.

'Plants of this kind,' she added, 'grow by creeping along under the ground, and these buds are the growing points.'

'Here is another of the same kind,' and she cleared away the soil round it.

SOLOMON'S SEAL.

'This is the underground stem of a plant called Solomon's seal. It has only one bud or growing point, and that is at the end. The scars on it mark the spots where the old stems grew year after year.'

'These thick solid creeping stems are so much like roots, that people often call them roots, or root-stocks,' she added.

'And now let me give you a surprise. These thick fleshy stems are like the thick fleshy roots. They contain a store of food, to keep the plant alive.'

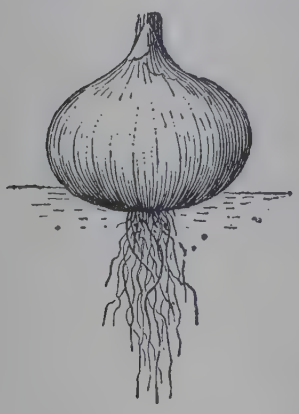
'Here are some more underground stems for you,' said Uncle Tom, who was digging up potatoes close by. 'Potatoes

POTATO.

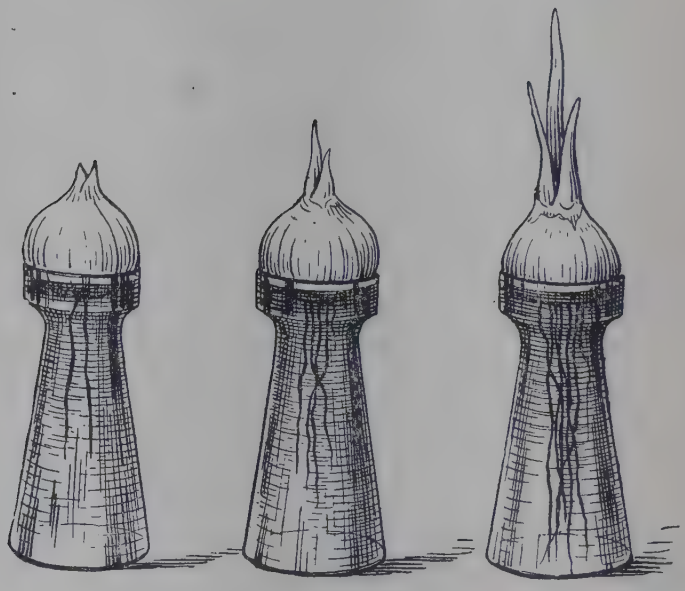
are not roots, although they are the underground part of the plant.'

'These "eyes" on the potato are really buds, and buds, you know, never grow on roots. The potato is part of the underground stem, swollen up into a sort of ball. It is meant as a store of food for the plant.'

'Look at this onion,' said Maude. 'You can see the root fibres hanging from it, so the onion itself is not the root. It is the stem swollen up into a sort of ball, or bulb.'



She showed them some onions, which she had been growing in bottles of water. One of them had already sent up a tall



stem, and was filling the bottle with quite a cluster of root-fibres.

'Where did they get the food to make them grow?' she asked. And then

she showed them that the onions themselves were now soft, flabby, and wasted. All the time they had been growing, they had been feeding on the food stored up in the bulbs.

Summary of the Lesson

1. Underground stems are often thick and fleshy. They contain a store of food for the plant.
2. The potato is not a root, but part of the underground stem, which has become swollen into tubers as a store of food to feed the plant.
3. The eyes are buds in the tubers.
4. Bulbs are the lower part of the stem swollen very large. They contain a store of food for the plant.

Lesson XXIII

The Dog

The boys were out for a scamper with Bruno, when they met their uncle. The moment the dog saw his master, he left them, and bounded away to meet him, wagging his tail, and barking loudly, to show how pleased he was.

'We have been running races with Bruno,' said Dick, 'but he can beat us.'

'Yes, my lad,' replied his uncle, 'dogs are running animals. That broad, deep chest, and those long powerful legs show that Bruno is made for running.'

'He can beat us in swimming too,' said

Harry. 'What fun we had at the pond! I wish I could swim as well as Bruno.'

'Yes, most dogs seem to love the water,' said Uncle Tom. 'Cats, you know, dislike water; they never go near it, even to wash themselves.'

'If the cat's fur gets wet, it clings about her body, and makes her uneasy;

but a dog simply gives himself a shake after his swim, and soon gets dry again.'

'Here, sit down on the grass, boys. We will have a chat about Bruno.'

'Hold up your paw, Bruno. You see he has five toes on the front, and four on the hind paws, just like the cat.'

'Yes,' said Charlie, 'and I see the toes are padded. Does he walk on his toes?'

'Yes, dogs, like cats, walk on their toes, Charlie,' said his father; 'but when Bruno runs, I can hear his feet on the ground, and I cannot hear the cat's feet. How is that? Both of them have pads.'

This was too much for Charlie, so Uncle Tom said, 'Look at Bruno's feet. He cannot draw back his claws as a cat does. Although his feet are padded, those claws rub the ground, and make a noise, at every step he takes.'

'Now, open your mouth, old boy,' he

added. 'His teeth, you see, are sharp and pointed. They are just like the cat's teeth. They are made for cutting through flesh, not for chewing. The lower jaw, too, has only one movement—up and down.'

'Poor old fellow, he is licking my hand,' said Dick. 'His tongue is soft and wet, not rough like the cat's tongue.'

'Ah,' said his uncle, 'the dog does not use his tongue to strip the flesh from bones. He does not need a rough tongue.'

'His head is not like the cat's head; is it, uncle?' said Harry. 'It is longer and more pointed.'

'That's right, Harry,' said his uncle. 'When a dog seizes a rat he snaps at it with those four long sharp teeth. The cat seizes her prey with her claws, but the dog's claws are too blunt for this, so he uses his jaws instead.'

'I see Bruno has no curtain in front of his eye, as the cat has,' said Dick, 'so I suppose he is not meant to be a night prowler.'

Summary of the Lesson

1. The dog is a running animal; it is made for running.
2. The dog shows whether he is pleased or angry by means of his tail.
3. The dog's feet are padded; but the claws cannot be drawn back. They have no sheath.
4. The dog seizes its prey with his teeth.
5. The dog laps water with his tongue.
6. The dog is not a night prowler. There is no curtain to shade its eyes.

Lesson XXIV

Dogs

'What a clever, fond, faithful fellow Bruno is, uncle,' said Dick.

'Yes, my boy,' said Uncle Tom, 'and he is as sensible as he is good.'

'There must be a great many kinds of dogs, uncle,' said Harry.

'Yes, Harry, there are,' he said. 'Let me see. First there are the Hounds. These are the best runners. They are all used in hunting.'

'The Grey-hound is the swiftest of all. He has a long slender body and legs. He is used for hunting the hare. He chases his prey by sight.'

'The Stag-hound is the largest and

GREY-HOUND.

strongest of the hounds. He has a rough shaggy coat. They use him for hunting the stag.'

'We see plenty of Fox-hounds about here,' said Charlie, 'don't we, father? They use them for hunting the fox.'

'Yes,' said his father. 'And then there are Blood-hounds and Deer-hounds. All these dogs have a strong sense of smell. They chase their prey by the scent.'

'The Spaniels are grand dogs too. The finest of them is called the Saint

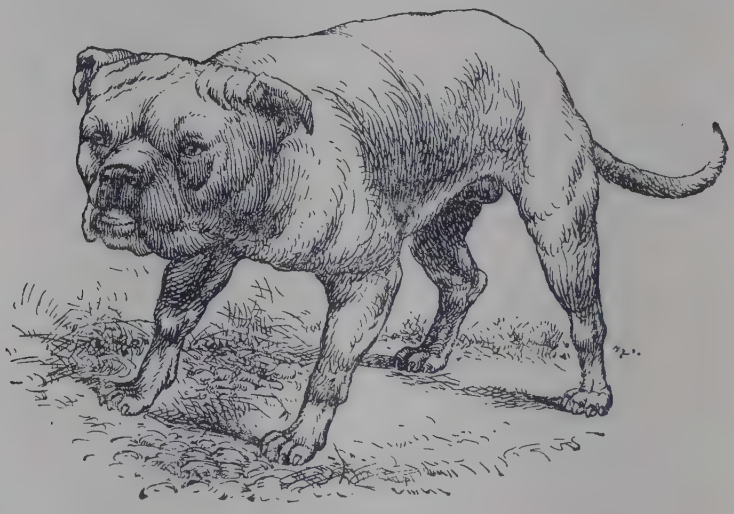
SAINT BERNARD.

Bernard Dog. He is very big and strong. He has a fine large head and a long shaggy coat. In some lands these grand dogs are used to find people, who have lost their way, and got buried in the snow.'

'Then there is that noble fellow, the New-found-land dog. He is a great

NEW-FOUND-LAND DOG.

strong dog, and is very fond of the



BULL-DOG.

water. He has saved many people from drowning.'

'The Bull-dogs are mostly kept as watch-dogs, to take care of the house at night. The biggest and strongest of these watch-dogs is the Mastiff.'

'The Sheep-dog is the most clever

SHEEP-DOG.

and sensible of all. This dog helps the shepherd to take care of his sheep.'

'Do you know, boys, that the wolf and the fox are only fierce savage dogs? They are some of Bruno's wild cousins.'

Summary of the Lesson

1. Hounds are hunting dogs. Some of them hunt by sight; others by scent.

2. The Saint Bernard and the Newfoundland are the largest and noblest of the spaniels.

3. The mastiff, bull-dog, and sheep-dog are very sensible and very useful.

4. The wolf and the fox are wild savage dogs.

Lesson XXV

A Spring

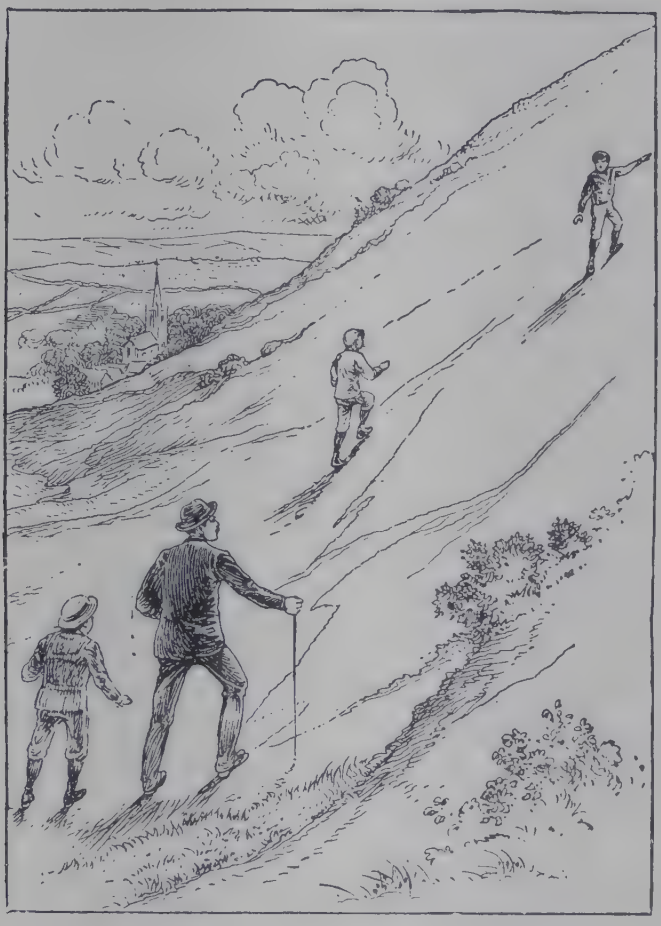
'Now, boys,' said Uncle Tom, when they had come to the end of their long journey, 'you have seen the hills from the train, and you have gone through one of them in that dark tunnel. I am now going to make you climb to the top of this one. So let us start at once.'

What fun they all had, to be sure, and what a scramble it was to get to the top! But they did get to the top at last, and then what a grand sight it was! There they stood on the crest or summit of that great mass of land, hundreds of feet above the level country all round.

'Look,' said Dick, 'that must be a town over there. I can count ever so

many church steeples, and there must be hundreds and hundreds of houses.'

'Look how the hill slopes down on this side,' said his uncle. 'At the bottom



of the slope another hill rises. There is quite a hollow between the hills?'

'Yes,' cried Dick, 'that is a valley.'

'Well, now you may all run about

and enjoy yourselves just as you like,' he said, and away they went for a scamper.

After a time they came running back very eager about something.

'Oh, do come and see what we have found, uncle,' they said, and they led him away down the slope of the hill.

'What is it?' he asked.

'Why, we have seen water coming out of the ground, uncle,' said Harry.

It was one of the finest sights the boys had ever seen. There, trickling out of the hill-side, was a little stream of clear sparkling water. It fell tumbling over the stones, which it had washed quite clean, and then away it flowed rippling along over the pebbles. It was so clear, too, that you could count the stones at the bottom.

'What is it, uncle?' they asked.

'It is a spring,' he replied. 'But I will tell you all about it.'

'The ground we walk on is made up

of many things—sand, gravel, clay, chalk, slate, and other rocks.'

'These things all lie in beds or layers

one under the other. Most of them are porous, and the rain sinks through them.'

'Clay is not porous, you know. The rain-water sinks down through the porous beds, but it cannot pass through

the clay. It collects there on the top of the clay bed, and at last, when the earth can hold no more, bursts through on the side of the hill, as you see it now. This is what we call a spring.'

Summary of the Lesson

1. The earth on which we walk is made up of sand, gravel, clay, chalk, slate, and other rocks.
2. These things all lie in beds or layers one under the other.
3. The rain soaks through some of them, such as chalk, sand, and gravel, because they are porous, but it cannot soak through clay, because clay is not porous.
4. When the water reaches the clay it collects there, till at last it finds a place where it can force its way out. It then bubbles up out of the ground, and forms a spring.

Lesson XXVI

A Chat about Leaves

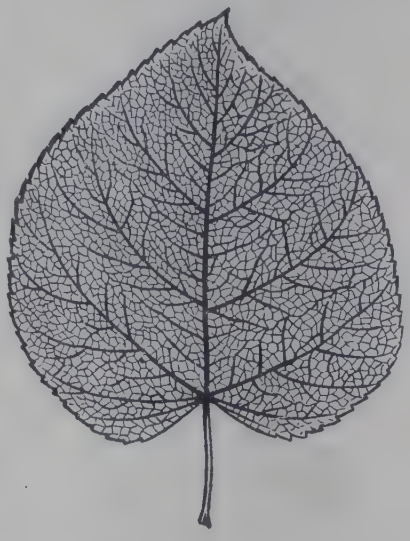
'Come and see my basket of leaves,' said Maude.

'It has taken us a long time to gather them. Hasn't it, Ella?'

'Let us sit down here in the garden, and see what we can find out about them.'

'Here is one. We will begin with that. You see, there are two parts to

the leaf. There is the thin, flat, broad part, which we call the blade. Then there is the long stalk, which joins the blade to the twig or branch, on which it grows. This is the foot-stalk.



'The leaves are not all the same shape,' she said, as she placed them side by side on the table. 'Here are round, oval, oblong, heart-shaped, and kidney-shaped leaves. Here are others that are something like a sword, a lance, an arrow, a wedge, and a needle. They have all sorts of shapes.'

'Now, let us notice the edges of the leaves next. This one, you see, has a smooth edge, this one has a wavy edge, and here are some others with edges like the teeth of a saw.'

'Now, take up any of these leaves on the table, and you see that one side is darker and smoother than the other.

This dark, smooth surface is the upper side of the leaf in each case. The under side of some of them is very rough.'

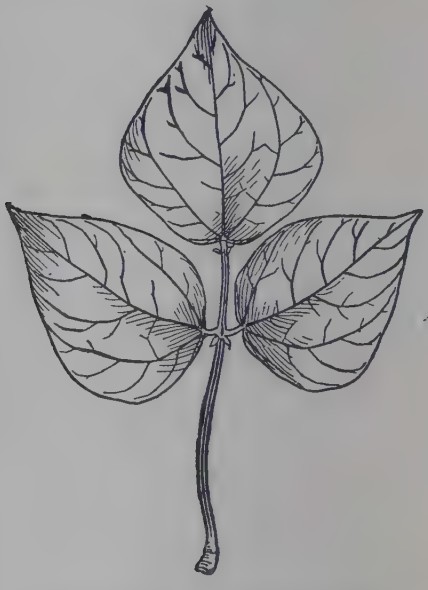
'What are these long ridges on the under side of the leaf?' asked Harry.

'They are the ribs of the leaf,' said Maude. 'They support the blade, and keep it well stretched out.'

'Each of these leaves, you see, has only one blade on the stalk,' she added. 'We call them simple leaves.'

'Now look at this rose-leaf. It has

ROSE-LEAF.



LEAF OF SCARLET RUNNER.

five blades on one stalk. Here is another from the scarlet runner, which has three

blades on the stalk. Here again is one from the horse-chestnut, with seven. These are all compound leaves.'

HORSE-CHESTNUT LEAF.

'There are joints in the stem or twig, and the leaves spring from these joints. In some plants a single leaf comes from each joint, just as you see in this lime-twig.

LIME-TWIG.

HOP.

LILAC.

In others there are two leaves at a joint, one on each side of the stem. The hop is one of these. In others again, like the lilac, the leaves are in pairs, but each pair crosses the other.'

'The leaves die and fall off in winter,' said Dick.

'Ah, some of them do,' said his cousin. 'But here are some leaves, that are green in the winter, when all other leaves are gone. Ivy, holly, box, and laurel are always green. We call them evergreens.'

'They are always green, because the old leaves do not die off, till the new ones are quite formed.'

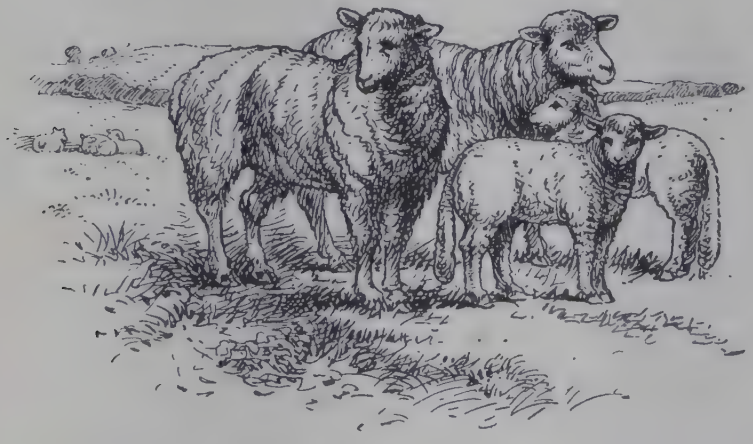
Summary of the Lesson

1. A leaf consists of the blade and the foot-stalk.
2. The blade is supported by ribs which spring from the foot-stalk.
3. Simple leaves have one single blade; compound leaves have several blades.
4. Leaves do not grow on the same parts of every plant.
5. The old leaves of evergreens do not fall till the new ones are quite formed.

Lesson XXVII

The Sheep

'What silly, timid things sheep are, father,' said Charlie. 'They begin to bleat and run away, if we go near them. I only wanted to put my hand on their woolly coats; I wouldn't hurt them.'



'Suppose we sit down here after our long walk, and have a chat about them,' said his father. 'Shall we, boys? We will begin with their thick, woolly coats.'

'This coat is not like the soft smooth fur of the cat, nor the hairy coat of the dog. We call it a fleece of wool. Sheep, you know, live in the open fields night

and day all through the year. They want a thick coat to keep out the cold.'

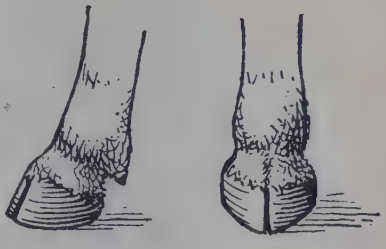
'Now notice their heads,' he went on.

'The eyes are placed at the sides of the head, not in front as ours are.'

'The ears are very sharp at hearing, and can be raised erect in a moment.'

'The nostrils are large and wide. They look like narrow slits now, but they can be opened wide in a moment.'

'All timid animals want sharp ears, sharp eyes, and a keen sense of smell, to warn them if danger is near. Then they can run away and save themselves.'



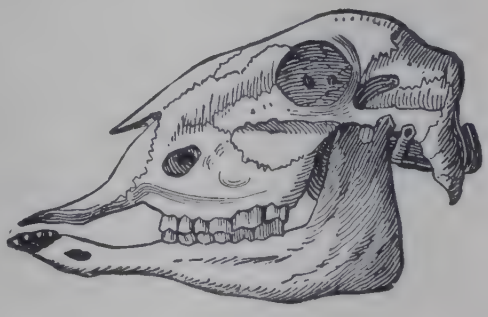
'This leads me to notice the feet next,' he said. 'Look at their feet. They have four toes; two large ones in front, and two little ones behind. The sheep walks on the two

front toes. Each toe has a hard horny case over it. We call the sheep's foot a hoof, and because it is split in two, we call it a cloven hoof.'

'Those that are lying down on the grass, uncle, are all moving their mouths, as if they were chewing,' said Harry.

'Yes, Harry, and they are really chewing,' said Uncle Tom. 'Let me make this quite clear to you.'

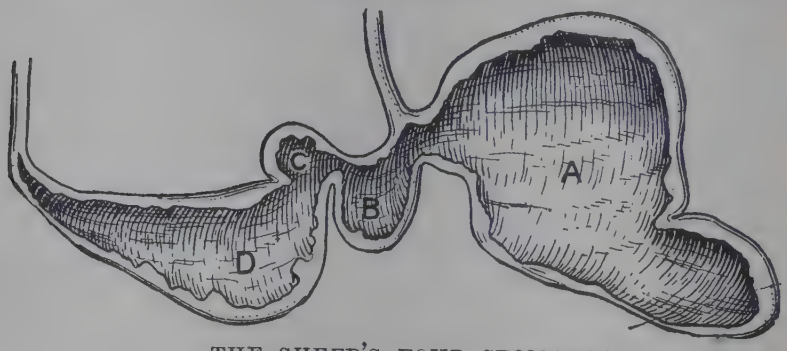
'The sheep has no teeth at all in the front of its top jaw. It has a thick hard pad there, but no teeth.'



'Watch those that are walking about eating the grass. They collect a tuft of grass with their long tongue and lips. The sharp cutting teeth in front of the lower jaw press it against the pad, and tear it off, and then the sheep swallow it, without waiting to chew it.'

'These mouthfuls of grass pass down

into a big bag, which we call the paunch. The sheep will not leave off eating till their paunch is full. All the time they lie there, they are bringing up the grass into their mouths again to be chewed.



THE SHEEP'S FOUR STOMACHS.

They have some strong grinders behind. When it is chewed, they swallow it again, but it goes down now into the real stomach.'

'We say the sheep chews the cud, for the grass is brought up in little balls or cuds to be chewed.'

Summary of the Lesson

1. The sheep's fleece of wool fits it to live in the open air in all weathers.

2. Sheep are timid animals. They have large ears, and their eyes are placed at the sides of the head—not in front.

3. The sheep has a cloven hoof. It walks on two toes.

4. The sheep has a pad in front of the upper jaw instead of teeth ; and strong grinders behind.

5. The sheep chews the cud.

Lesson XXVIII

The Pig

When uncle went to feed his pigs, the boys, of course, used to go with him.

They liked to watch the hungry greedy things trample over one another,

and grunt and squeak, when the food was thrown into their trough.

'Look Dick,' said Harry one day, 'pigs, as well as sheep, have cloven hoofs. Do they chew the cud too, uncle?'

'No, my lad,' said his uncle, 'although

they have cloven hoofs, they do not chew the cud. Look into the trough, and see what they are eating.'

'There are pieces of bread, pudding, meat, potatoes—waste of all kinds from the table. Nothing comes amiss to them; they eat anything and everything.'

'See,' he added, 'the trough is empty at last. Now watch them.'

The pigs one by one, finding there was no more to eat, went and lay down, with their little eyes almost shut. But they did not move their jaws to chew their food, for they had chewed it, as they took it out of the trough.

'Pigs are not like sheep,' said Uncle Tom. 'They have only one stomach.'

'They have great grinding teeth behind, like those of the sheep, but there is no pad in front of the top jaw. Both jaws have sharp strong teeth in front.'

'Look at that fellow's broad strong snout,' he added. 'Pigs like to grub in the ground for acorns, beech-nuts, and

roots. This strong snout is to do the grubbing work. They have a fine time of it with the fallen fruit, when I let them run loose in the orchard.'

'But if they happen to find their way into the potato-field, they make sad ruin of my potatoes with their grubbing.'

'The long, sharp nose of the dog, the wide open mouth of the cat, and the soft movable lips of the sheep are each fitted for the work they have to do. But that work is not to grub in the ground.'

'What large wide ears, and little sharp eyes they have, uncle,' said Dick.

'Yes, and their sight and hearing are very sharp, I can tell you,' he said.

'The pig is a very useful animal. We eat its flesh, which we call pork and bacon. We make leather from its skin, and brushes from its bristles.'

SUMMARY OF THE LESSON

1. The pig does not chew the cud. It has only one stomach.
2. It has teeth in front of both jaws.
3. It has a strong snout for grubbing in the ground.
4. The pig, like the sheep, has a cloven hoof.
5. We eat its flesh ; its skin is made into leather, and we use its bristles for making brushes.

Lesson XXIX

ABOUT FLOWERS

'May we have a chat about flowers this

morning, Cousin Maude?' asked Harry.

'Yes,' said Maude. 'Go with Ella

and gather some flowers. I shall be ready for a chat soon.'

'Now,' she said when Ella and the boys came back, 'look at the heap of flowers on the table. They are all made up of leaves, but they are not green like real leaves. They are gay with all sorts of beautiful colours. If we touch them we find them very soft, smooth, and tender. These are the flower-leaves.'

'All flowers have not the same number of flower-leaves. The wall-flower and

WALL-FLOWER.

PANSY.

LILY.

the poppy have four, the butter-cup and the pansy have five, and the lily has six.'

'Some flower-leaves are joined at their edges to form a sort of bell or cup.'

SWEET-PEA.

'Here is one just like a butterfly in shape. It is a pea-blossom.'

Then she showed them a daisy, and this was made up of a great many tiny flowers packed close together.

DAISY.

'Flowers, you see, are as unlike one another in shape, as they are in colour,' she said, and then she began to strip off the pretty flower-leaves one by one.

When she had pulled them all off, she showed the children some long slender stalks, standing up in a ring inside.

These she called stamens, and she pointed out the little box, or case, on the top of each of them.

She broke one of these little boxes, and it was full of yellow dust, or pollen.

'This part of the flower, you see, is not at all like the flower-leaves,' said Maude. And she pulled off the stamens, as she had pulled off those leaves.

When she had done so, the children saw that there was one stalk left, standing up in the middle of the ring.

The lower part of this stalk was swollen, bigger than the rest, and Maude cut it open with her knife.

'Why, those must be tiny seeds inside it,' said Dick and Harry in one breath.

'Yes, boys, they are the seeds, sure enough,' said Maude. 'It is the work of the flowers to produce the seeds.'

SUMMARY OF THE LESSON

1. All flowers have not the same number of flower-leaves.
2. Flowers are not all the same shape.
3. The stamens are little stalks which support the anthers.
4. The seeds are formed in a little case in the middle of the flower.
5. It is the work of the flower to produce the seeds.

Lesson XXX

A RIVER

'One day I saw you floating your boats in the gutter, by the side of the road,' said Uncle Tom. 'Why did the boats move along?'

'The stream of water carried them along as it flowed,' said both the boys.

'And why did the water flow?'

'Because water always tries to get as low as it can,' said Dick.

'Where did the water come from?'

'It came from the rain. It rained very hard all that morning,' said Harry.

They were all watching the river from the bridge, and just as Harry spoke, his uncle let a stick fall into the water.

'Look, uncle, the stick is floating away, just as our boats did in the gutter,' said Dick. 'Is the river a running stream?'

'It is,' said his uncle, 'and the stick

shows which way the river runs. Like all other water, of course, it *flows down.*'

'But where does all this water of the river come from, uncle?' asked Harry.

'Well, my lad, we could find that out,

if we took a boat and rowed *up the stream.* But there would be some hard rowing, to get to the place, where the river begins, for it is a long long way off.'

'To see the very spot where it begins, we should have to get out of our boat, and climb the hills. Then, somewhere on the hill-side, we should find water bubbling up out of the ground.'

'Why, that would be a spring, uncle,' cried Dick, 'and springs are formed by the rain, which soaks into the earth.'

'Yes, Dick, the rain makes the spring, and the spring makes the river.'

'The place, where a river begins, is called its source. The water comes up out of the earth in the form of a spring, and so we say the river rises there.'

'You would like to see the river at its source, boys,' he added. 'It is such a tiny stream, that you could easily jump across it. We call it a brook then.'

'But what makes the tiny brook grow into a big river, uncle?' asked Dick.

'Well, you see, there are other springs on all the hills round about,' said his uncle, 'and the water from them must flow in streams down the hill-sides.'

'All these streams flow along till they join the first one. We call them the feeders, because they pour their water into the big one, and make it grow bigger and bigger.'

'What becomes of the river at last, uncle?' asked Harry.

'The river flows along, growing all the time bigger, broader, and deeper, till at last it pours its water into the sea,' replied his uncle.

Summary of the Lesson

1. A river is a stream of water flowing over the land.
2. Rivers are formed from the rain. The rain makes the spring. The spring makes the river.
3. The place where the river begins is called its source.
4. The river flows because, like the water in the gutter, it is always trying to get as low as it can.
5. The little streams which flow into the river are called its feeders.
6. Rivers flow on, till they pour their water into the sea.

Lesson XXXI

Another Chat about the Sun

'It is just twelve o'clock, boys,' said Uncle Tom, pulling out his watch. 'Do you see where the sun is?'

'Yes, uncle,' said Harry, 'it is now at its highest point in the sky.'

'How do you know?' he asked.

'Because it seems to move across the sky in an arch, day by day, and it is now at the top of the arch,' said Dick.

Uncle Tom stood Dick with his back to the sun, and told him to stretch out both his arms in a line with one another.

'There,' he said, 'you are now pointing to the two ends of the arch.'

'Yes,' said Dick, pointing with his right hand, 'that end is where the sun rises in the morning. It is the east.'

'The other end, on my left, is the west, where the sun sets in the evening.'

'Look at Dick's shadow on the ground,' said Harry. 'It looks just like a cross.'

'So it does,' said his uncle, 'and the four parts of the cross point four ways. One points to the east, one to the west, one towards the sun, and one away from the sun.'

'And now,' he went on, 'it is time for you to learn two new names.'

'When you see the sun at twelve o'clock in the day, you will say it is in the south. If you then turn your back to the sun, as Dick did just now, you will be looking in a straight line away from it. You will be facing the north.'

'You cannot make a mistake, for it is the same every day, all through the year. The sun is always in the south at

twelve o'clock, and the north points in a straight line away from the south.'

'You know the other two points.'

'Yes,' said Harry, 'the one on the right is the east, that on the left is the west.'

'Good,' said his uncle. 'Now, you see, we have four points marked—north, south, east, and west. We will call them the four car-din-al points. It is a long word for little boys, but it only means the four chief points.'

'If you know how to find these four points, they will always tell you which way to go from one place to another.'

'They are easy to find. If at twelve o'clock in the day you turn your back to the sun, you know you are facing the north, and you have the east on your right hand, and the west on your left.'

Summary of the Lesson

1. North, south, east, and west are called the four cardinal points.

2. The sun rises in the east. It is always in the south at noon. It sets in the west.

3. We never see the sun in the north.

4. When we turn our backs on the sun at noon, we have the north in front of us, the east on our right hand, and the west on our left.

5. These four points show us the way from one place to another.

Lesson XXXII

About the Stars

'We know how to find the north, south, east, and west now, Cousin Maude. Don't we, Dick?' said Harry.

'The sun is always in the south at twelve o'clock, you know. So if we turn our back to the sun then, we have the north in front of us, the east on our right hand, and the west on our left.'

'That's quite right, Harry,' said Maude. 'Shall I show you how to find them just as easily at night, when the sun is not shining?'

'Oh yes, please tell us all about it,' cried both the boys.

'Well, I can't tell you now,' she said, 'but we will go out and have a look at the stars when it gets dark, if you like.'

Evening came, and the boys were

there gazing up into the sky, as soon as the stars began to peep out.

'What a lot there are,' said Dick. 'We could never count them, could we? But here comes Cousin Maude.'

'Now, boys,' she said, 'if you look where I am pointing, you will see seven stars—much larger and brighter than any of the others near them. They are placed like this,' and she marked them out with her pencil on a sheet of paper.

'People have given these seven stars very funny names. Some call them the Plough. They say that the four stars form the plough itself, and the three others in a line make the handles.'

'Others call them the Waggon and Horses, or Charles's Wain. The word wain means a waggon.'

'Others again call them the Great Bear, with a long tail. I don't care which name you give them. But I want you to fix in your mind the figure, which these seven stars make.'

'Now run your eye through the two end ones, up and up in a straight line. Then you will find another very large

and bright star. That is the one we want—the North Star.'

'The two end ones are called the pointers. They point out the North Star.'

'We call it the North Star, because it stands over the north part of the world.

When we face it, and walk towards it, we are walking towards the north.'

SUMMARY OF THE LESSON

1. The North Star helps us to find the four cardinal points at night when the sun is not shining.
2. To find the North Star, we must look for Charles's Wain.
3. Charles's Wain is formed by seven large bright stars.
4. The two end stars are called the pointers, because they point out the North Star.

Lesson XXXIII

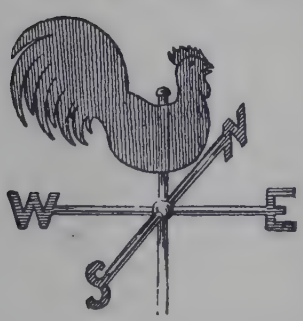
THE WEATHER-COCK

'I know at last why uncle has that funny cock-a-doodle on the top of the barn,' said Dick. 'It tells him what the weather is going to be. He calls it a weather-cock.'

'It must be a very clever bird,' said Harry. 'How does it do that, uncle?'

'I will tell you,' said Uncle Tom.

'You see, first of all, there are four

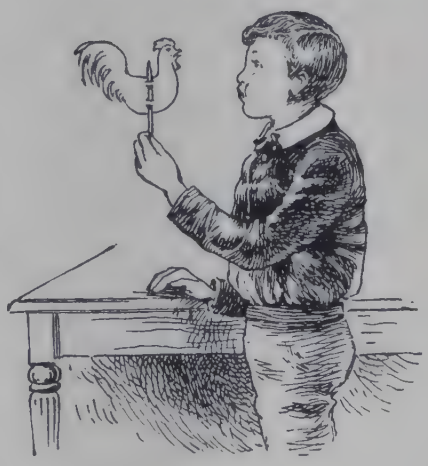


arms with the letters N. E. S. W. at the ends of them. These arms are fixed. One points to the north, one to the east, one to the south, and one to the west.'

'The bird, you know, is not fixed. It moves round on that spike.'

'Wait a moment. I will make you one with this piece of stiff paper.'

So saying, he cut out a paper figure of the weather-cock. He then made two small slits in it, and pushed his lead pencil through the slits.



'There,' he said, 'now blow as hard as you can against the bird, and you will see how it works.'

'That's funny,' said Dick. 'The bird spins round at once, and looks me straight in the face. Here, you try it, Harry.'

Harry did so, and then Uncle Tom had a try. The bird spun round and faced them each time.

'Can you tell me now why the cock-a-doodle on the roof of the barn spins round?' asked Uncle Tom.

'The wind blows it round, just as

our breath blows this one round,' said Dick.

'Yes, it does,' he replied, 'and you can tell which way the wind is blowing, for the bird's head always faces the wind.'

'But why does it face the wind?' asked Dick. 'That's just the puzzle.'

'Well, you see, when I made our paper bird just now, I fixed it on the pencil much nearer the head than the tail,' said his uncle. 'When we blow, we must blow the big broad tail part away from us, so the head always faces the wind.'

'The weather-cock is fixed in the same way, and so it always faces the wind.'

'But what has the wind to do with the weather, uncle?' asked Harry.

'I will tell you,' he replied. 'The north winds come from a part of the world, where there is ice and snow all the year round. These are cold biting winds.'

'You know the little song—

The north wind doth blow,
And we shall have snow.'

'The south winds blow from lands, where ice and snow are never seen. They bring us warm weather.'

'The east winds blow from a cold quarter of the world. They are dry stinging winds. They chap our hands and faces and lips.'

'The west winds come across the great wide sea. They are loaded with clouds of vapour. They bring the rain.'

Summary of the Lesson

1. The weather-cock tells us which way the wind is blowing.
2. It is called the weather-cock, because when it shows us the quarter from which the wind is blowing, it also tells us what kind of weather is coming.
3. The north wind brings cold weather; the south wind warm weather.
4. The east wind is a dry stinging wind which chaps our skin; the west wind brings the rain.

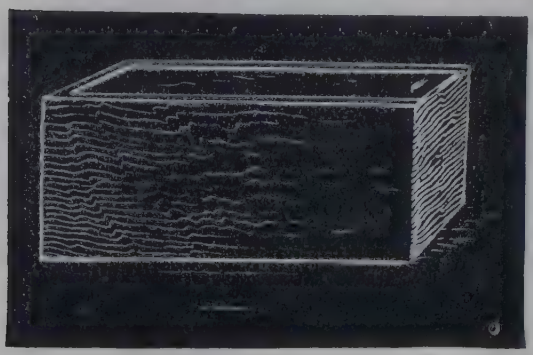
Lesson XXXIV

About Plans

'You seem very busy, uncle,' said Dick.

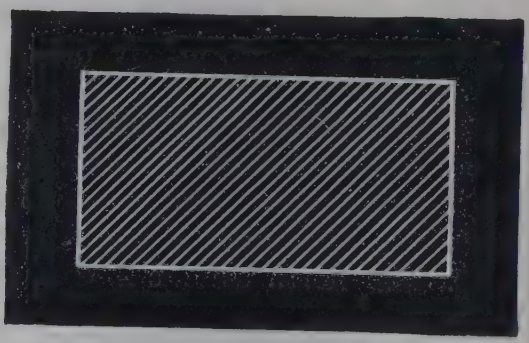
'Yes,' said his uncle, 'I am making some rough plans for my new stables.'

'Oh,' said Dick, 'we know what plans are. Don't we, Harry?'



'Teacher showed us how to make plans at school. Look, I will make a plan of this box,' and he ran a chalk line round it. Then he lifted the box away, and the shape of it was marked out on the ground.

'This is a plan of the box,' he said; 'it shows us the shape and size of it.'



PLAN OF THE BOX.

'That's very good, my lad,' said Uncle Tom. 'I can see you know the meaning of a plan, so let us have a look at this plan of my new stables.'

'Can you tell me, by looking at it, what is to be the shape of the stables?'

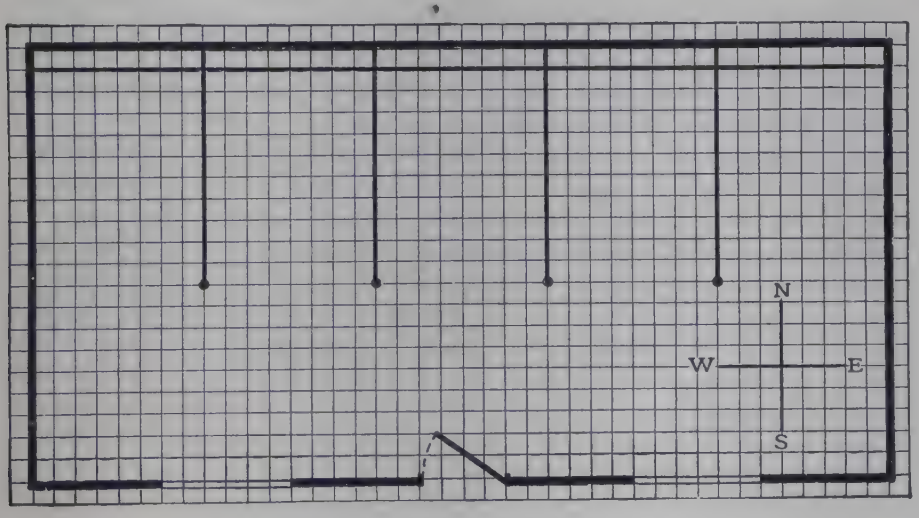
'Oblong,' cried both the boys.

'How do you know?' he asked again.

'Because those four lines—two long ones and two short ones—stand for the walls,' said Dick, 'and they make an oblong drawing on the paper.'

'That's right,' said his uncle.

'You see I have drawn it on squared



PLAN OF THE STABLE.

paper. The squares make it easy to get the exact size, and a plan, you know, must show size as well as shape.'

'Each square is a quarter of an inch across, and stands for a foot on the real stables.'

'Can you tell me, from the plan, how big the stables are to be?'

'Yes,' said Harry in a minute or so, 'forty feet long, and twenty feet wide.'

'How did you know that?'

'I counted the squares,' said Harry. 'There are forty squares along the line,

PICTURE OF THE STABLE.

which stands for one wall, and twenty squares along the other line.'

'The plan is drawn to scale, and the scale is a quarter of an inch to a foot.'

'Right,' said his uncle. 'Now look at this one. You see the drawing is just the same shape, but it is much larger.'

'It is drawn on paper ruled in squares an inch across. But every square stands for a foot, and so this plan is larger than the other. It is drawn to a larger scale. We can make a plan, you know, to any scale we please.'

There was to be a door leading into the stable, and a window on either side of the door. The boys had no trouble in pointing all this out on the plan.

'Now, last of all,' said Uncle Tom, 'the plan tells me the position of the stable, as well as its size and shape.'

'Oh yes,' said Dick, 'the four cardinal points in the corner tell that. The door is in the south wall.'

Summary of the Lesson

1. A plan shows the shape and size of the ground on which a thing stands.
2. Plans must be drawn to scale, if they are to show size as well as shape.
3. We can make a plan to any scale we please.
4. The four cardinal points are always marked on the plan, to show position as well as shape and size.

Lesson XXXV

Another Chat about Plans

'Can we make plans of anything else, besides stables and houses and things of that sort, uncle?' asked Harry.

'Oh yes,' replied his uncle. 'We will make a plan of another sort now.'

'Let me see,' he said. 'We will first fix upon a scale. Suppose we say our new scale is to be one foot to half a mile.'

'And can you really make a foot stand for half a mile?' asked Dick.

'Yes, that's easy,' said his uncle.

'But what things can you show in a plan like that, uncle?' asked Harry.

'You shall see,' he replied, and he wrote the letters N. S. E. W. on the four edges of the paper, to show the four cardinal points.

'Now,' he said, 'you know our house stands at the corner of the road.'

'You know too that, when you stand at the gate, and look down the road at

twelve o'clock, the sun is straight in front of you. Can you tell me from this which way the road runs?'

'South,' cried both the boys at once.

'And you know that, if you turn your back to the sun at noon, you are looking towards the north,' he added.

'Oh yes, uncle,' said Dick. 'So the other end of the road runs north.'

'That's right,' said his uncle. 'Now think of the road, which crosses this one, at the corner of the farm.'

'That must run from east to west, for it goes straight across,' said Harry.

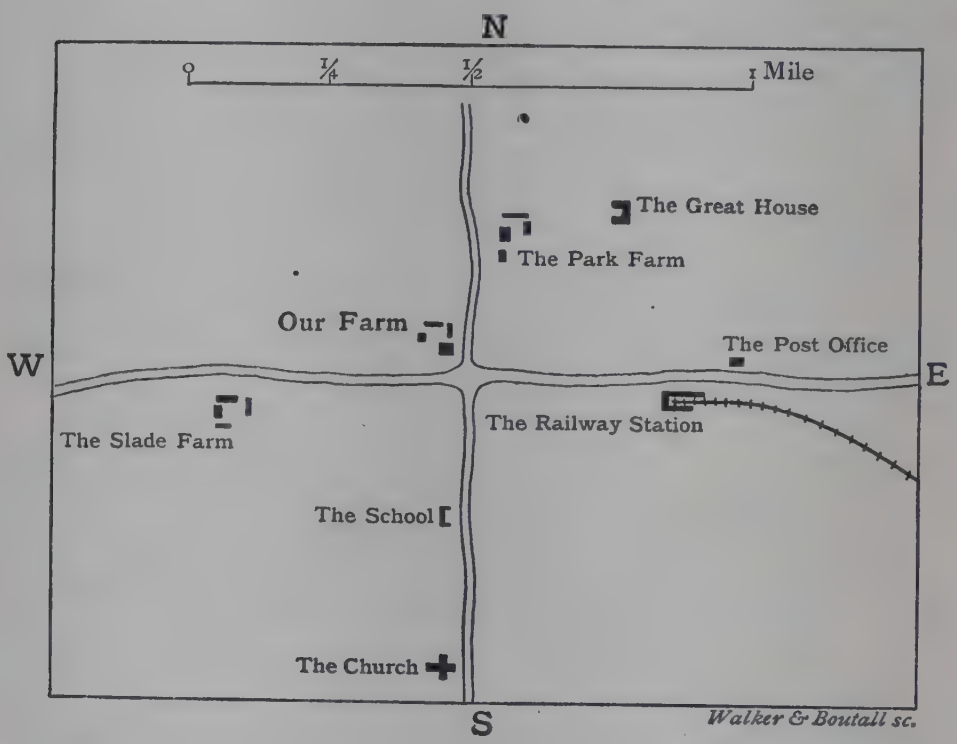
'Right again, boys,' said Uncle Tom. 'Now let us start with our plan. We will begin at this point in the middle of the paper, and I will draw two lines, side by side, from north to south, and two others crossing them from east to west.'

'I suppose those lines stand for the roads, uncle,' said Dick, 'and the farm must be just here, where the roads cross.'

'Good,' said his uncle, 'and I want to

put in our house and the rest of the farm buildings next. They won't be very large, of course, on this paper, but our plan will show us where they stand.'

'Now,' he added, 'I know it is just



half a mile from our house to the church. So if I measure one foot along the road towards the south, I shall know where the church is to come. And the school is just half-way between us and the church.'

'A quarter of a mile along the road to the north is the Park Farm, and behind

it, lying back from the road, is the Great House. Suppose we put them in next.'

'And now I must go,' he added, 'but you may mark in other places for yourselves, such as the railway station, the post office, the Slade Farm, and so on.'

'This, you see, is a plan of all the places for half a mile round us. We may call a plan of this sort a map.'

Lesson XXXVI

Plans and Maps

'Are all the maps on the walls at school really plans, like the one you made for us this morning, uncle?' asked Dick.

'Yes, Dick, all maps are plans.'

'But I don't think I ever saw houses, and churches, and schools, marked on any of those maps,' said Dick.

'No, my lad,' said his uncle, 'those maps are drawn on too small a scale, to show things of that sort. They show hills and rivers and towns. They show

the position of places, and how far it is from one place to another.'

'Let us have a look at this map,' he added, as he spread it out on the table.

'The scale, you see, says one inch to five miles. Every inch on the map stands for five miles. We must not look for houses and churches in a map like this.'

'You see these round black spots. Each of them stands for a large town, where thousands of people live.'

'Of course there is nothing in them to remind us of a town, but we use this mark to show the place, where the real town stands. Then we can tell how far it is from one town to another, and the direction in which the towns lie.'

'Look at this long wavy line, which stretches right across the map,' he added, 'It stands for a river, but it is no more like a real river, than those two lines on our other plan were like a road.'

'It shows us where the river runs, and how it winds about. That is all.'

'Then I suppose,' said Harry, 'this

thin-looking part of the line is the

source — the place where the river begins.'

'Yes,' said his uncle, 'and you can now tell me which way the river flows.'

'It flows from north to south,' said Harry, as he ran his eye over the four cardinal points in the corner of the map.

'And those other wavy lines running into the big one must be the feeders of the river,' said Dick. 'It seems very easy to read a map after all.'

'Yes, boys, you are both right,' said Uncle Tom. 'Now look at these strange shaded parts of the map. They stand for the hills. Of course, they are not a bit like hills.'

'But when we look at the map, we know at once the nature of the ground. We can tell which part is made up of hills and valleys, and which is flat.'

'Our map, you see, tells us at a glance all we want to know about towns, rivers, hills, valleys, and plains.'

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